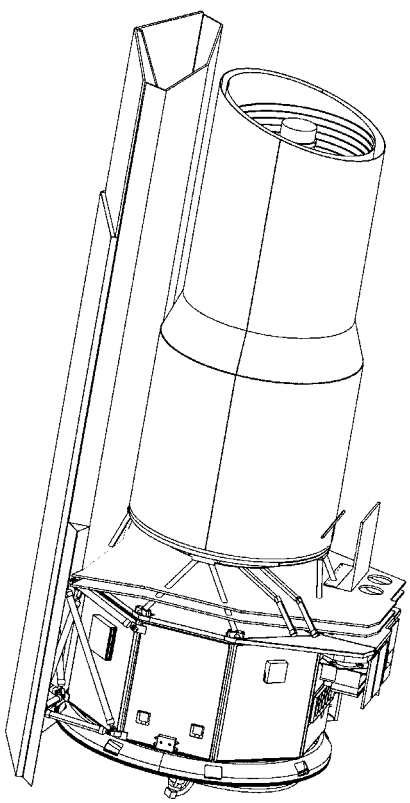
Space Infrared Telescope Facility
Environmental Assessment

National Aeronautics and
Space Administration



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National Aeronautics and Space Administration
Office of Space Science
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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California
D-16578

ENVIRONMENTAL ASSESSMENT

FOR SPACE INFRARED TELESCOPE FACILITY (SIRTF) LAUNCH AT CAPE CANAVERAL AIR FORCE STATION (CCAFS), FLORIDA

Lead Agency:	National Aeronautics and Space Administration (NASA)
Proposed Action:	The proposed action is to place a one-meter liquid helium-cooled infrared telescope into deep space. It would carry instruments to conduct imaging and spectroscopic observation over the infrared (IR) portion of the spectrum from 3 to 180 microns (μm) (1.18×10^{-4} to 1.09×10^{-3} inches [in]).
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Abstract:

This Environmental Assessment (EA) addresses the proposed action to complete the integration and launch the Observatory of Space Infrared Telescope Facility (SIRTF) mission from Cape Canaveral Air Force Station (CCAFS), Florida, no earlier than July 2002. The SIRTF Observatory would be composed of a spacecraft, a telescope, and liquid helium cooled instruments. The SIRTF Observatory would be assembled and tested at Lockheed-Martin Space Systems, Sunnyvale, CA, and shipped to Kennedy Space Center in Florida for checkout. The Observatory would then be transferred to Launch Complex 17 on CCAFS. The baseline launch vehicle would be the Delta II 7920H. The SIRTF Observatory would be injected by the second stage into a trajectory with the minimum energy required to escape Earth's gravity. The mission would last up to five years.

Alternatives to the proposed action considered included those that: (1) utilize an alternate launch vehicle/upper stage combination, (2) utilize an alternate launch site, or (3) eliminate the SIRTF mission (the No-Action alternative).

TABLE OF CONTENTS

Figures

Tables

ACRONYMS AND ABBREVIATIONS

45SW	45th Space Wing
AGN	Active Galactic Nuclei
ACHP	Advisory Council on Historic Preservation (federal)
AIHA	American Industrial Hygiene Association
AIRFA	American Indian Religious Freedom Act
AlCl	Aluminum chloride
AlClO	Aluminum chloride oxide
$AlCl_2$	Aluminum bichloride
$AlCl_3$	Aluminum trichloride
Al_2O_3	Aluminum Oxide
Al_2O_3(A)	Aluminum Oxide (aqueous)
Alt	Altitude
AQCR	Air Quality Control Region
Ar	Argon
ARPA	Archeological Resources Protection Act
AU	Astronomical Unit
AXAF	Advanced X-Ray Astrophysics Facility, (renamed Chandra X-Ray Astrophysics Observatory)
Be	Beryllium
BEMC	Brevard County Emergency Management Center
C	Celsius temperature scale, Carbon
C_3	Injection Energy (km^2/sec^2)
CA	California
Caltech	California Institute of Technology
CCAFS	Cape Canaveral Air Force Station
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CGRO	Compton Gamma Ray Observatory
CH_4	methane
Cl	Chlorine
Cl_2	diatomic chlorine
cm	centimeter(s) = 0.01 m = 0.3937 inch
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CTA	Cryo-Telescope Assembly
dBA	decibels, A-weighted
deg	degrees
DLA	angle of declination
DMCO	Delta Mission Check-Out
DoD	Department of Defense

DRMO	Defense Reutilization and Marketing Office
DSN	Deep Space Network
EA	Environmental Assessment
EEGL	Emergency Exposure Guidance Level
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ER	Eastern Range
ERPG	Emergency Response Planning Guideline
ESA	European Space Agency
ETR	Eastern Test Range
EWR	Eastern-Western Range
F	Fahrenheit temperature scale
FCREPA	Florida Commission on Rare and Endangered Plants and Animals
FDA	Florida Department of Agriculture
FDEP	Florida Department of Environmental Protection
FDH	formaldehyde
FGFWFC	Florida Game and Fresh Water Fish Commission
FNAI	Florida Natural Areas Inventory
ft	feet
ft/s	feet per second
FTS	Flight Termination System
FWS	Fish and Wildlife Service
g	gram
gal	gallon
GEM	graphite epoxy motor
H	hydrogen
H_2	diatomic hydrogen
H_2O	water
HCl	Hydrochloric Acid or hydrogen chloride
HNO_3	Nitric Acid
Hp	horsepower
HST	Hubble Space Telescope
HTPB	Hydroxyl-Terminated Polybutediene
IDLH	Immediately Danger to Life or Health
In	inch(es)
Incl	inclination
IR	infrared
IRAC	Infrared Array Camera
IRAS	Infrared Astronomical Satellite
IRS	Infrared Spectrograph
IRU	Inertial Reference Unit
JPL	Jet Propulsion Laboratory

K	Kelvin, absolute temperature scale, -273.4 degrees Celsius = 0 K
KSC	Kennedy Space Center
kg	kilogram = 2.2 pounds
km	kilometer = 1,000 meters = 0.62 mile
km/s	kilometers per second
l	liter
lb	pound(s)
LBS	Launch Base Support
LC-17	Launch Complex 17
LDXL	Large Diameter Extended Length
LMSS	Lockheed Martin Space System
LV	Launch Vehicle
m	meter(s) = 39.37 in
MAC	maximum allowable concentration
Mbps	million bits per seconds
MECO	main engine cut off
mg	milligram
mg/m^3	milligram per meter cubed (mass per volume)
mg/l	milligrams per liter
mg/ml	milligram per milliliter
mi	mile(s)
MIC	multiple instrument chamber
MIPS	Multiband Imaging Photometer for SIRTF
ml	milliliter(s)
min	minute(s)
MLV	Medium Launch Vehicle
m/s	meters per second
MSPSP	Missile System Pre-Launch Safety Package
$\mu g/m^3$	micrograms per cubic meter (0.000001 gram/meter^3)
μm	micron (or micrometer) = 0.000001 meter = 3.937×10^{-5} in
NAAQ	National Ambient Air Quality
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NaOH	Sodium Hydroxide
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NDMA	nitrosodiumethylamine
NEPA	National Environmental Policy Act
N_2	diatomic nitrogen
N_2H_4	Hydrazine
N_2O_4	Nitrogen Tetroxide
NH_3	Ammonia
NHL	National Historic Landmark

NHPA	National Historic Preservation Act
Nmi	nautical mile(s)
NO	Nitrogen oxide
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides (generic)
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
O	oxygen
O_2	diatomic oxygen
O_3	ozone
OFW	Outstanding Florida Water
OH	hydroxide
OSHA	Occupational Safety and Health Administration
PAFB	Patrick Air Force Base
Pb	Lead
PCRS	Pointing Calibration and Reference Sensor
PEL	Permissible Exposure Limit
pH	level of acidity or alkalinity relative to water
PHSF	Payload Hazardous Servicing Facility
PLF	payload fairing
PM	particulate matter
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
RCRA	Resource Conservation and Recovery Act
REEDM	Rocket Exhaust Effluent Diffusion Model
RLA	right angle of ascension (of launch asymptote)
ROI	Region of Influence
RP-1	thermally stable kerosene fuel
s	second
S/C	Spacecraft
S&A	Safe and Arm
sec	second
SECO	second engine cut off
SHPO	State Historic Preservation Office
SIRTF	Space Infrared Telescope Facility
SO_2	Sulfur Dioxide
SPCCP	Spills Prevention, Control, and Countermeasures Plan
SPEGL	Short-term Public Emergency Guidance Level
sq	square
SRM	Solid Rocket Motor
SRP	Safety Review Panel

SSC	SIRTF Science Center
STEL	Short Term Exposure Limit
STP	Sewage Treatment Plants
STS	Space Transportation System
t	time
TDS	total dissolved solids
TLV	Threshold Limit Value
TRI	Toxic Chemical Release Inventory
TWA	time weighted average
UDMH	Unsymmetrical Dimethyl Hydrazine
USAF	United States Air Force
VAFB	Vandenberg Air Force Base
Vel	velocity

EXECUTIVE SUMMARY

PROPOSED ACTION

This environmental assessment (EA) addresses the proposed action to complete the integration and launch of the Space Infrared Telescope Facility (SIRTF) Observatory (hereafter referenced as the SIRTF Observatory) from Cape Canaveral Air Force Station (CCAFS), Florida, no sooner than July 2002. The SIRTF Observatory would be assembled and tested at Lockheed-Martin Space Systems (LMSS), Sunnyvale, CA, and shipped to Kennedy Space Center (KSC) in Florida for checkout. The Observatory would then be transferred to Launch Complex 17 (LC-17) on CCAFS.

The baseline launch vehicle, a Delta II 7920H[1], would be assembled in facilities at CCAFS before being transferred to LC-17. The Delta II 7920H consists of a liquid bipropellant main engine, a liquid bipropellant second stage engine, and nine Large Diameter Extended Length (LDXL) graphite epoxy motor (GEM) strap-on solid rockets. While most of the check-out of the SIRTF Observatory and launch vehicle (LV) would be performed at individual integration buildings, operations completed at the launch site would include mating of the Observatory with the launch vehicle, integrated systems test and check-out, launch vehicle liquid propellant servicing, and ordnance installation.

PURPOSE AND NEED FOR THE ACTION

The proposed action is to place a liquid helium cooled infrared (IR) telescope into deep space. It would carry instruments to conduct imaging and spectroscopic observation over the IR portion of the electromagnetic spectrum from 3 to 180 microns (µm) (1.18×10^{-4} to 1.09×10^{-3} inches [in]). In order to achieve the mission science objectives, SIRTF would be extremely sensitive to IR radiation. Its telescope and instruments would be cooled by evaporating liquid helium to reduce the telescope’s own thermal emission. This would ensure that the thermal emissions from the optical assembly would not overwhelm those originating from the target objects. To improve its sensitivity and to minimize the amount of liquid helium needed, it would be placed in deep space, far away from the Earth’s thermal emissions.

The SIRTF mission would directly support the National Aeronautics and Space Administration (NASA) mission to “advance and communicate scientific knowledge and understanding of the Earth, the solar system, and the universe, and use the environment of space for research.” Specifically, the NASA Strategic Roadmap envisions, in the period between 1996 to 2002, that to advance and communicate scientific knowledge, we will survey the universe and solar system, explore nature’s processes in space, and characterize the entire Earth system. SIRTF would make a major contribution to two of those three strategies. With

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[1]The Delta II 7920H was renamed the Delta 2920H in 2001; however, the launch vehicle designation has not changed for the SIRTF mission.

unprecedented sensitivity, SIRTF would survey both the universe and solar system in the IR portion of the electromagnetic spectrum. In so doing, significant new discoveries are expected, based on the limited samples of information that have been received by less capable earlier missions. Many of nature's processes occur at wavelengths outside the visible range. By observing the infrared sky, processes yet undiscovered are expected to be revealed and investigated.

The SIRTF mission would be the pathfinder for several advancements in technology needed for future astrophysics missions. Its 85-centimeter (cm) (33.5 inches) primary mirror would be constructed of lightweight beryllium, compared to the 60-cm (23.6 inches) beryllium mirror previously flown on the Infrared Astronomical Satellite (IRAS) in 1981. Unlike previous infrared telescope missions, the SIRTF telescope would not be inside the cryostat[2], and, thus, would be launched at ambient temperature. It would be cooled by radiation to space during the early part of the mission. This warm launch architecture would enable a much larger single piece primary mirror in a launch vehicle fairing than previous missions such as IRAS. SIRTF would validate the performance of this warm launch concept and pave the way for future missions with much larger primary mirrors. SIRTF would be the first to use an Earth-trailing orbit which would eliminate the interference of thermal emissions from the Earth, and, at the same time, would require no propulsion system for trajectory correction. Three future astrophysics missions are planning to adopt the Earth-trailing orbit as their baseline mission design and mission operations approach: the StarLight mission, the Space Interferometry Mission (SIM), and the Kepler mission. SIRTF would use the Deep Space Network (DSN) for communication at 2.2 million bits per second (Mbps), which would be a new capability useful for future missions.

MISSION DESCRIPTION

The SIRTF baseline plan calls for the Observatory to be launched on the Delta II 7920H launch vehicle from the Eastern Test Range at CCAFS, Cape Canaveral, Florida. The 7920H is a 2-stage version of the commercial Delta II with the high performance solid motor strap-on boosters used by the commercial Delta III. The second stage would inject the SIRTF Observatory into an Earth escape trajectory. The escape trajectory would place the SIRTF Observatory into a heliocentric orbit that trails the Earth with a receding rate of 0.12 Astronomical Unit[3] (AU) (17,951,520 kilometers [km], 11,154,600 miles [mi]) per year. Unlike planetary launches, there is no planetary alignment restriction on the SIRTF launch period. SIRTF would launch no earlier than July 2002.

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[2] A cryostat is like a thermos bottle. The cryostat, filled with liquid helium, cools the telescope and the instruments, and insulates them from the outside environment.

[3] An Astronomical Unit is the mean distance between the sun and the Earth, 149,596,000 km (92,955,000 miles).

The SIRTF Observatory would use a solar panel and battery for power, nitrogen gas for reaction control, and liquid helium for telescope and instrument cooling. There would be no propulsion system and no radioactive material. There would be no new or modified Government or contractor facilities needed to process the SIRTF Observatory at the launch complex.

ALTERNATIVES CONSIDERED

Alternatives to the proposed action that were considered included those that: (1) utilize an alternate launch vehicle/upper stage combination, (2) utilize an alternate launch site, or (3) eliminate the SIRTF mission (the No-Action alternative).

Alternate Launch Vehicles

The most desirable launch vehicle for SIRTF would meet, but not greatly exceed, the mission's minimum launch performance requirements. Other considerations in the selection of a launch vehicle include reliability, cost, and potential environmental impacts associated with the use of the vehicle. Of the several alternative U.S. and foreign launch vehicles considered, the Delta II 7920H most closely matches the SIRTF mission requirements:

- The mass performance of the Delta II 7920H most closely matches the SIRTF performance requirement.
- The Delta II 7920H is the more reliable alternative launch system of those systems meeting the SIRTF performance criteria.
- The Delta II 7920H is the lowest cost alternative launch system of those systems meeting the SIRTF performance criteria.
- The Atlas II launch vehicle could contribute less potential environmental impacts than the Delta II 7920H because it does not have the solid rocket boosters, but it exceeds the launch capability of the Delta II 7920H by approximately 1000 kg, and would cost significantly more than the Delta II 7920H.

Alternative Launch Sites

CCAFS and Vandenberg Air Force Base (VAFB) have the only currently approved facilities to launch Delta II launch vehicles. Since the Delta II is the preferred launch vehicle for the SIRTF mission, alternate launch sites to CCAFS and VAFB would not be available.

The direction of launch, commonly referred to as flight azimuth, depends on range safety considerations that prohibit flying over certain land and ocean areas. Flights from VAFB must launch west and south to avoid overflying the heavily populated West Coast. This means that the launch vehicle is moving in the direction opposite to Earth’s rotation. Launches from CCAFS are toward the east and in the direction of Earth’s rotation, and thus do not require the extra fuel to achieve the same orbit as those originating from VAFB. Therefore, a larger launch vehicle would be required to launch SIRTF onto the same trajectory from VAFB.

No-Action Alternative

The No-Action alternative would result in termination of the mission, which would disrupt the progress of NASA's Great Observatory and Origins Programs. The SIRTF mission is the culmination of more than a decade's planning to extend our knowledge of our solar system, our galaxy, and the Universe. The No-Action alternative would eliminate or delay the acquisition of scientific knowledge of our solar system, our galaxy, and the Universe. In preparation for SIRTF, the infrared astronomical community and NASA have invested more than ten years of technology development in infrared detectors. The No-Action alternative would prevent the application of these large format IR detectors in the advancement of science. The No-Action alternative would also delay or prevent the validation of technologies critical to future astrophysical missions. These technological areas include the use of lightweight mirror, the warm launch architecture, the Earth escape orbit without the need of a propulsion system, and the high data-rate deep space communication. While minimal environmental impacts would be avoided by cancellation of the single launch, the loss of the scientific knowledge and database that could lead to future technological advances would be substantial.

SUMMARY OF ENVIRONMENTAL IMPACTS

The only expected environmental effects of the proposed action are associated with normal launch vehicle operation and are summarized below.

Air Quality

In a normal launch, exhaust products from the Delta II 7920H are distributed along the launch vehicle's flight path. The portion of the exhaust plume that persists longer than a few minutes (the ground cloud) is emitted during the first few seconds of flight and is concentrated near the pad area. It consists of the rocket exhaust effluents and deluge water. Prior to launch all personnel are evacuated from the launch site to areas a minimal distance outside the facility perimeter until the area has been monitored and declared clear.

The Air Force uses the Rocket Exhaust Effluent Diffusion Model (REEDM) to determine the concentration and areal extent of launch cloud emission dispersion from LVs. For this assessment, Air Force personnel from 45SW ran REEDM for the Delta II 7920H LV nominal launch case (normal launch mode) in two different weather scenarios (2 runs). The model was also run for two failure modes (conflagration and deflagration) in two credible weather scenarios (4 runs). (A credible weather scenario is one in which launch would proceed.)

Because the cloud rises so rapidly, surface exposure to the cloud immediately after launch is assumed to occur for approximately two minutes for this analysis. The model predicted that the cloud would stabilize approximately 3 km (1.9 mi) from LC-17. Concentrations for carbon monoxide (CO), carbon dioxide (CO_2), chlorine (Cl), aluminum oxide (Al_2O3), and hydrochloric acid (HCl) were considered. For all species considered, the distance range between launch pad and the peak concentration is from 12 to 14 km (5.7 to 8.6 mi) downwind of LC-17 for the first weather scenario and 8 to 10 km (5 to 6 mi) downwind in the second weather scenario. REEDM outputs predict that the 60-minute average concentrations would be less than 0.05 ppm for all species considered for a normal launch in either of the two weather scenarios. Even at the peak concentration of toxic effluents, appropriate health and safety exposure limits would not be exceeded and hence no impacts to human health are anticipated.

During the last twenty years there has been an increased concern about human activities that are affecting the upper atmosphere. Space vehicles that use solid rocket motors (SRMs) have been studied concerning potential contribution to stratospheric ozone (O_3) depletion because of their exhaust products, with the primary depleting component being HCl. Other ozone depleting chemicals considered were Nitrous Oxides (NO_x) and Al_20_3. The average global depletion rates for the types of chemicals emitted were calculated as a percent of O_3 reduction per ton of exhaust emissions. Currently, SIRTF is the only mission using the Delta II 7920H configuration. Based on an average of twelve Delta II mixed fleet launches per year (one 7320, three 7420, seven 7920, one 7920H) it is estimated that the cumulative net stratospheric ozone depletion due to these exhaust products for twelve Delta II launches in a twelve-month period would be approximately 1.03×10^{-2} percent.

In addition to the near-pad acidic deposition that could occur during a launch, there is a possibility of acid precipitation from naturally-occurring rain showers falling through the ground cloud shortly after launch. Since the ground cloud for a Delta II launch is predicted to be very small (radius of about 100 m or 328 ft), concentrates around the launch pad, and disperses quickly, there should be no substantial amount of acidic deposition beyond the near-pad area.

Land Resources

Overall, launching a Delta II vehicle would not be expected to have substantial negative effects on the landforms surrounding LC-17. However, launch activities could have some small impacts near the launch pad associated with fire and acidic depositions. Minor brush fires are infrequent by-products of Delta launches, and are contained and limited to the ruderal vegetation within the launch complexes; past singeing has not permanently affected the vegetation near the pads. Wet deposition of HCl could damage or kill vegetation, but would not be expected to occur outside the pad fence perimeter.

Local Hydrology and Water Quality

Water, supplied by municipal sources, is used at LC-17 for fire suppression (deluge water), launch pad washdown, and potable water. The deluge water would be collected in the flume located directly beneath the launch vehicle and flow into a sealed concrete catchment basin, where it would then be disposed of in accordance with applicable federal and state regulations and permit programs. A concrete exhaust flume on each pad deflects exhaust gases away from the pad to reduce the noise and shock wave that result from ignition of solid rockets and the first stage of the launch vehicle. Most of the pad washdown and fire suppressant water would also be collected in a concrete catchment basin, and any propellant release would occur within sealed trenches and should not contaminate runoff. If the catchment basin water meets federal discharge criteria, it would be discharged directly to grade at the launch site. If it fails to meet the criteria, it would be treated on site and disposed to grade or collected and disposed of by a certified contractor.

The primary surface water impacts from a normal Delta II launch involve HCl and Al_2O_3 deposition from the exhaust plume. The ground cloud would not persist or remain over any location for more than a few minutes. Depending on wind direction, most of the exhaust may drift over the Banana River or the Atlantic Ocean. A brief acidification of surface waters may result from HCl deposition. A normal Delta II launch would have no substantial impacts to the local water quality due to the amount of water available for dilution.

<u>Ocean Environment</u>

In a normal launch, the first stage and the SRMs would impact the ocean. The trajectories of spent stages and SRMs would be programmed to impact at a safe distance from any U.S. coastal area or other landmass. Toxic concentrations of metals would not be likely to occur due to the slow rate of corrosion in the deep ocean environment and the large quantity of water available for dilution.

Spent stages would have relatively small amounts of propellant. Concentrations in excess of the maximum contaminant level of these compounds for marine organisms would be limited to the immediate vicinity of the spent stage. No substantial impacts would be expected from the reentry and ocean impact of spent stages, since the amount of residual propellants would disperse in the large volume of water available, and therefore, would not constitute a danger to the marine environment.

<u>Biotic Resources</u>

A normal Delta II launch would not be expected to substantially impact CCAFS terrestrial, wetland, or aquatic biota. The elevated noise levels of a launch are of short duration and would not substantially affect wildlife populations. Wildlife encountering the launch-generated ground cloud could experience brief exposure to exhaust particles, but would not experience any substantial impacts. If the launch were to occur immediately before a rain shower, aquatic biota could experience acidified precipitation. This impact would be expected to be insignificant due to the brevity of the small ground cloud and the high buffering ability of the surrounding surface waters to rapidly neutralize excess acidity.

<u>Radioactive Materials</u>

The proposed design of the SIRTF Observatory includes no radioactive materials. Thus, there is no radiological risk to the health and safety of human life or the environment from this mission.

Threatened and Endangered Species

The U.S. Fish and Wildlife Service (FWS) has reviewed those actions which would be associated with a Delta II launch from LC-17 and has determined that those actions would have no effect on state or federally listed threatened (or proposed for listing as threatened) or endangered species residing on CCAFS and in adjoining waters or critical habitats. Please refer to Section 4.1.6.

Population and Economics

The SIRTF mission would create negligible impact on local communities, since no additional permanent personnel would be expected beyond the current CCAFS staff. Launch Complex 17 has been used exclusively for space launches since the late 1950s. The SIRTF mission would cause no additional adverse impacts on community facilities, services, or existing land uses.

Pollution Prevention

NASA

In compliance with Executive Order (EO) 12856, “Pollution Prevention and Community Right-to-Know,” NASA has developed a comprehensive agency program to prevent adverse environmental impacts by: 1) Moving ahead of environmental compliance; 2) Emphasizing pollution source elimination and waste reduction; 3) Involving communities in NASA decision processes; 4) Purchase environmentally preferable products and services to the maximum extent practicable; 5) Publicize and promote NASA's use of environmentally preferable goods and services through convenient and cost-effective methods such as the World Wide Web (WWW) and other types of electronic distribution; 6) Review and revise as necessary NASA specifications and standards as applicable to eliminate barriers to the preference for recovered materials; and, 7) Submit Annual Affirmative Procurement Progress Reports to the Federal Environmental Executive Committee.

USAF

The 1996 45 SW Pollution Prevention Program Guide (PPPG) and Pollution Prevention Management Action Plan satisfy requirements of the Pollution Prevention Act of 1990. The PPPG also complies with requirements in DoD Directive 4210.15, AFI 32-7080, and the Air Force Installation PPPG. The PPPG establishes the overall strategy, delineates responsibilities, and sets forth specific objectives for reducing pollution of the ground, air, surface water, and groundwater. The purpose of the PPPG is to provide sufficient guidance for pollution prevention management on Patrick AFB and CCAFS. Specific goals include implementation of management practices that eliminate or reduce the use of hazardous materials, increase efficiency in the use of raw materials, protect natural resources, and encourage source reduction through recycling, treatment, and disposal practices.

The SIRTF mission would comply with both NASA and USAF pollution prevention policies and guidelines.

Environmental Justice

EO 12898 directs Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on low-income populations and minority populations. Given the launch direction and trajectories of the SIRTF mission, analysis indicates little or no potential of substantial environmental effects on any human populations outside CCAFS boundaries, and there would be no disproportionately high or adverse human health or environmental effects on minority or low-income populations.

Safety and Noise Pollution

Normal operations at CCAFS include preventative health measures for workers such as hearing protection, respiratory protection, and exclusion zones to minimize or prevent exposure to harmful noise levels or hazardous areas or materials.

The engine noise and sonic booms from a Delta II launch are typical of routine CCAFS operations. In the history of USAF space-launch vehicle operations at CCAFS, there have been no problems reported as a result of sonic booms. To the surrounding community, the noise from this activity appears, at worst, to be an infrequent nuisance rather than a health hazard.

Cultural Resources

Since no surface or subsurface areas would be disturbed, no archeological, historic, or other types of cultural sites would be expected to be affected by launching the SIRTF mission.

POTENTIAL LAUNCH ACCIDENTS

Liquid Propellant Spill

The potential for an accidental release of liquid propellants would be minimized by strict adherence to established safety procedures. Post-fueling spills from the launch vehicle would be channeled into a sealed concrete catchment basin and disposed of according to the appropriate state and federal regulations.

The most severe propellant spill accident scenario would be releasing the entire launch vehicle load of nitrogen tetroxide (N_2O_4) at the launch pad while conducting propellant transfer operations. This scenario would have the greatest potential impact on local air quality. Airborne NO_x levels from this scenario are expected to be reduced to 5 ppm within about 150 m (500 ft) and to 1 ppm within approximately 300 m (1,000 ft). Activating the launch pad water deluge system would substantially reduce the evaporation rate, limiting exposure to concentrations that are above federally established standards to the vicinity of the spill. Propellant transfer personnel would be outfitted with protective clothing and breathing equipment. Personnel not involved in transfer operations would be excluded from the area.

Launch Vehicle Destruction

In the unlikely event of a launch vehicle destruction, either on the pad or in-flight, the liquid propellant tanks and SRM cases would be ruptured. Due to their hypergolic (ignite on contact) nature, a launch failure would result in a spontaneous burning of between ten and thirty percent of the liquid propellants, and a somewhat slower burning of SRM propellant fragments. Any such release of pollutants would have only a short-term impact on the environment near the pad.

Launch failure impacts on water quality would stem from unburned liquid propellant being released into CCAFS surface waters. For most launch failures, propellant release into surface waters would be substantially less than the full fuel load, primarily due to the reliability of the vehicle destruct system. However, if there were an early flight termination and failure of the vehicle destruct system, it is remotely possible that the entire Stage II propellant quantity could be released to the ocean. Second stage propellants are water-soluable and should disperse quickly. Impacts to ocean biotic systems would be localized, transient in nature, and these systems would be expected to recover rapidly, due to dispersion of the propellant in the large quantity of ocean water.

Under normal or catastrophic launch scenarios, concentrations would not be hazardous except in the immediate vicinity of the launch pad for approximately two minutes after launch or near the centroid of the launch cloud for a short time after the launch. The launch cloud would be several hundred meters above ground level, depending on weather conditions. These hazardous concentrations near the centroid of the launch cloud would persist for an estimated ten minutes, but could occur for shorter or longer periods depending on meteorological conditions. Airplanes are not allowed near the CCAFS area during launches. Prior to launch, personnel are cleared from the areas where potential hazardous concentrations would occur, and there should be no hazard to humans associated with exhaust effluents.

Failure of the second stage is considered a credible, although unlikely, accident scenario, and thus the SIRTF Observatory would fail to achieve escape velocity. In this scenario, the SIRTF Observatory would autonomously separate from the second stage and its orbit would decay. Some elements of the SITRF Observatory, particularly the parts of the telescope that are shielded by the helium tank and shells, would likely survive atmospheric re-entry and would impact the Earth. The probability of such an accident causing injury to a human is extremely small.

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SECTION 1

PURPOSE AND NEED

The National Aeronautics and Space Administration (NASA) has prepared this Environmental Assessment (EA) for the Proposed Action of completing the preparations for and implementing the launch of the Space Infrared Telescope Facility (SIRTF) mission, including integration of the SIRTF Observatory with its launch vehicle and its launch from Cape Canaveral Air Force Station (CCAFS), Launch Complex 17 (LC-17), Florida, no earlier than July 2002. This EA discusses the mission's objectives as well as its potential environmental impacts. Feasible alternatives to the proposed action are also examined. Among the possible effects that will be considered are air and water quality impacts, local land area contamination, adverse health and safety impacts, the disturbance of biotic resources, economic impacts, and adverse effects in wetland areas and areas containing historical sites. This document was completed in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321, et seq.), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508), and NASA's policy and procedures (14 CFR Subpart 1216.3).

1.1 PURPOSE OF THE PROPOSED ACTION

The National Aeronautics and Space Act of 1958 as amended, established in pertinent part, a mandate to conduct activities in space that contribute substantially to the "expansion of human knowledge of the Earth and of phenomena in the atmosphere", ((42 U.S.C. 2451 et seq.)(d)(1)(5)), and to "the preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere." In response to this mandate, NASA, in coordination with the National Academy of Sciences (NAS), has developed a prioritized set of science objectives to be met through a long-range program of astrophysics missions (i.e., the Great Observatories Program and the Origins Program). These missions are designed to be conducted in a specific sequence based on technological readiness, launch opportunities, timely data return, and a balanced representation of scientific disciplines.

NASA's strategy to carry out these programs is to conduct a series of observatory missions. The Space Infrared Telescope Facility (SIRTF) is planned by NASA as a companion observatory to the Hubble Space Telescope (HST), Chandra X-Ray Astrophysics Observatory (formerly named AXAF), and Compton Gamma Ray Observatory (CGRO). SIRTF would be the first mission to combine the high sensitivity achievable from a cryogenic space telescope with the imaging and spectroscopic power of the new generation of infrared (IR) detector arrays. The great scientific potential of such a mission led to SIRTF's designation by the National Research Council (NRC), Astronomy and Astrophysics Survey Committee as the highest priority new major mission for all of US astronomy in the 1990's. [NRC 1991]. This recommendation was revalidated in 1994 by a second National Academy committee that reviewed the redefined SIRTF mission, capable of being launched on a smaller launch vehicle (LV) than the Space Transportation System (Space Shuttle).

The SIRTF mission would directly support the National Aeronautics and Space Administration (NASA) mission to “advance and communicate scientific knowledge and understanding of the Earth, the solar system, and the universe, and use the environment of space for research.” [NASA 2000-A] The purpose of the SIRTF mission is to place a one-meter class liquid helium-cooled telescope in deep space to conduct observations in the following four high priority scientific programs:

SIRTF would search for cold objects (brown dwarfs and super planets) with masses from 0.1% to 5% that of the sun; these bodies are not thought to be massive enough to ignite nuclear reactions. These objects may contain a significant fraction of the mass of the Galaxy and, yet, cannot be seen in the visible wavelength. Their thermal emission radiates in the infrared.

SIRTF would determine the structure and composition of disks of material around nearby stars, the presence of which implies that these stars may harbor planetary systems. Such planetary debris disks absorb heat from the central star and re-radiate in the infrared. Surveying the number of stars in our galaxy harboring such disks, and studying the composition of such disks using spectroscopic measurements would provide insight into the abundance of solar systems similar to our own.

SIRTF would study the evolution of ultraluminous[4] galaxies and quasar populations and probe their interior regions to study the character of their energy sources. It is believed that many of these galaxies are powered by a black hole in their center and many of them emit the bulk of their luminosity at IR wavelengths. A comprehensive survey of these galaxies would provide insight into the evolution of galaxies.

SIRTF would conduct deep surveys to yield valuable insight into how the number and properties of galaxies changed during the earliest epochs of the Universe. The expansion of the Universe means that more distant objects are moving away at higher velocities. The higher velocity induces the red-shift effect on their emissions. Infrared observations allow us to observe galaxy formation from the distant past, as early as 1/10 of the age of the Universe.

1.2 NEED FOR THE PROPOSED ACTION

SIRTF would be able to detect the missing mass within our galaxy, search for solar systems near our own, discover the energy source of some of the most energetic galaxies, and

[4] A galaxy is considered ultraluminous when it is more than 10 times brighter than the Milky Way.

study the formation of astronomical objects in the early Universe. A liquid helium cooled infrared telescope placed in the cool deep space could accomplish these science objectives.

The SIRTF mission would be the pathfinder for several advancements in technology needed for future astrophysics missions. Its 85-centimeter (cm) (33.5 inches) primary mirror would use lightweight beryllium, compared to the 60-cm (23.6 inches) beryllium mirror previously flown on the Infrared Astronomical Satellite (IRAS) in 1981. Unlike previous infrared telescope missions, the SIRTF telescope would not be inside the cryostat[5], and, thus, would be launched at ambient temperature. It would be cooled by radiation to space during the early part of the mission. This warm launch architecture would allow a much larger single piece primary mirror that could be stowed in a Delta II fairing. SIRTF would validate the performance of this warm launch concept and pave the way for future cryogenically-cooled telescope missions with much larger primary mirrors. SIRTF would be the first to use an Earth-trailing orbit that would eliminate thermal emission from the Earth, and, at the same time, would require no propulsion system for trajectory correction. Three future astrophysics missions are planning to adopt the Earth-trailing orbit as their baseline mission design and mission operations approach: the StarLight mission, the Space Interferometry Mission (SIM), and the Kepler mission. SIRTF would use the Deep Space Network for communication at 2.2 million bits per second (Mbps), which would be a new capability useful for future missions.

[5] A cryostat is like a thermos bottle. The cryostat, filled with liquid helium, cools the telescope and the instruments, and insulates them from the outside environment.

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SECTION 2

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

This section describes the Proposed Action of completing the preparation for and implementing the launch of the Space Infrared Telescope Facility (SIRTF) mission, which includes integration of the SIRTF Observatory with a Delta II 7920H launch vehicle, and launch from Launch Complex-17 (LC-17) at Cape Canaveral Air Force Station (CCAFS). Alternatives to this Proposed Action, including the No-Action alternative, are discussed in Section 2.2.

2.1.1 Mission Description

The SIRTF mission would involve placing a single spacecraft (hereafter referenced as the SIRTF Observatory) into a heliocentric orbit. The SIRTF Observatory would be launched on a Boeing Delta 7920H[1] launch vehicle from the Eastern Test Range at CCAFS, Cape Canaveral, Florida. The 7920H is a 2-stage version of the commercial Delta II with the high performance solid rocket motor (SRM) strap-on boosters used by the Delta III. The launch trajectory would include an ascent phase and a short coast of less than 30 minutes. The second stage would then inject the SIRTF Observatory into an Earth-escape trajectory. This trajectory would place the SIRTF Observatory into a heliocentric orbit with a period of about 372 days. Since this orbital period is longer than one year, it would result in the SIRTF Observatory moving away from the Earth at a rate of 0.12 Astronomical Unit (AU) ((17,951,520 kilometers [km], 11,154,600 miles [mi]) per year. (An AU is the average distance of the Earth from the sun and equals 149,596,000 km [92,955,000 mi]). After the expected mission life of five years, the SIRTF Observatory would be approximately 0.6 AU from Earth. Figure 2-1 depicts the SIRTF Observatory position relative to the Earth over its 5-year mission. The Earth is fixed at the center of the x-y coordinates and the Sun is at 1 AU away. Unlike planetary launches, there is no planetary alignment restriction on the SIRTF launch period. SIRTF would launch no earlier than July 2002.

The SIRTF Observatory would use a solar panel and battery for power, nitrogen gas for reaction control, and liquid helium for telescope and instrument cooling. There would be no propulsion system and no radioactive material. There would be no deployment mechanism except for the dust cover that would be ejected a few days after launch. The primary mission lifetime would last from 2.5 to 5 years depending on the usage of liquid helium that cools the telescope and the instruments. Communications with the Earth would be via the NASA Deep Space Network (DSN). Scientific and engineering data would be stored on-board and downlinked to the DSN once or twice a day.

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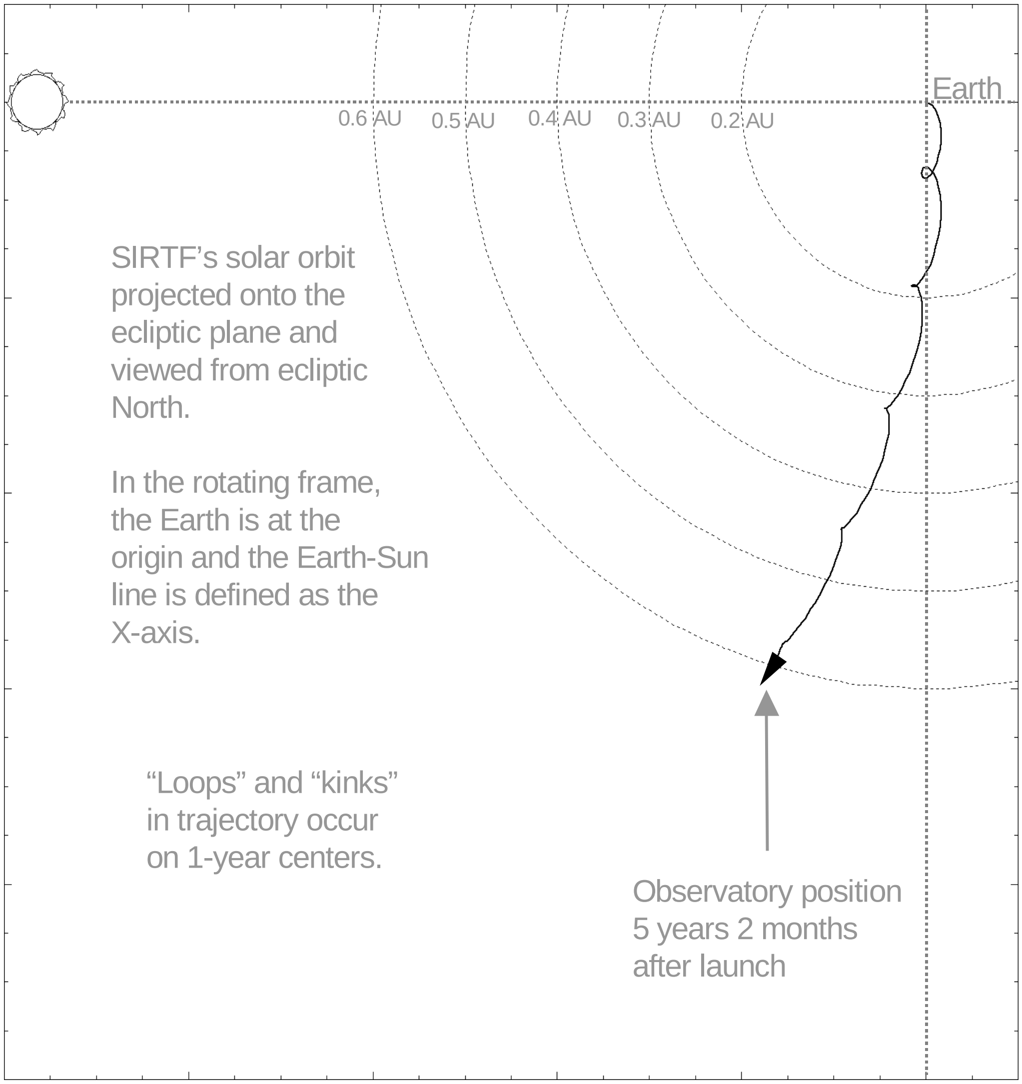
[1]The Delta II 7920H was renamed the Delta 2920H in 2001; however, the launch vehicle designation has not changed for the SIRTF mission.



Source: [CIT 2000]

Figure 2-1 SIRTF Solar Orbit

The SIRTF Observatory's three instruments would provide imaging and photometry at infrared (IR) wavelengths from 3 to 180 micron (μm) (1.18×10^{-4} to 7.09×10^{-3} inches [in]), and spectroscopy from 5 to 100 μm (1.97×10^{-4} to 3.94×10^{-3} in). Among the three instruments, there would be a total of ten instrument fields of view, all of which could view the sky at all times. Telescope body motions would be used to place science targets in an instrument field of view. Except for one instrument having a scan mirror and one having a dark shutter, there would be no other moving parts in the instruments.

The SIRTF science program would be conducted by the SIRTF science center, which would be located at the California Institute of Technology (Caltech) campus. The SIRTF science center would be responsible for the selection of the SIRTF science program and for the preparation of a set of observation requests that execute that program. The SIRTF flight operations would be conducted at JPL using the Multi-Mission Operations facilities. No new or modified Government or contractor facilities would be needed to conduct launch or operations.

2.1.2 Mission Science Objectives

The SIRTF science objectives are derived from the recommendations of the National Research Council (NRC), Astronomy and Astrophysics Survey [NRC 1991]. The areas of scientific investigation for the SIRTF mission are summarized in the following paragraphs.

2.1.2.1 Search for Brown Dwarfs and Super Planets

The presence of “missing mass” or “dark matter” – which is unseen but which makes its presence felt by its gravitational effect on stars and gas – is a persistent and puzzling feature of the universe. In our galaxy, for example, there is strong evidence for a spherical halo of dark matter that contains about 90 percent of the mass of the galaxy but has not been identified by direct detection at any wavelength. One as-yet-untested possibility is that a substantial component of this dark matter is in the form of “brown dwarfs” – objects with masses less than ~0.08 solar mass (one solar mass is 2×10^{29} kg [4.4×10^{29} lb]), which are too low in mass to generate the high central temperatures and pressures required to trigger the nuclear fusion reactions that power stars. Brown dwarfs, while much cooler and less luminous than stars, should glow faintly in the infrared as the internal heat generated in their formation diffuses. SIRTF – operating in a survey mode – would be able to detect brown dwarfs if they are common enough to constitute a significant fraction of the dark matter in the solar neighborhood.

The quest for planetary systems outside our own is part of the fundamental motivation for astronomical exploration. The recent detection of radial velocity measurements of Jupiter-sized companions to fifty nearby solar-type stars indicates that many types of planetary systems will be found, and SIRTF could play a crucial role in continuing this search. A brown dwarf has a substantial internal energy source and actually radiates to space several times more heat than it absorbs from the Sun. Planets larger than Jupiter radiate proportionately greater amounts of power, and SIRTF could detect the infrared emission from planets just a few times more massive than Jupiter if they are orbiting the nearest stars.

2.1.2.2 Discover and Study Protoplanetary and Planetary Debris Disks

Infrared observations are particularly important for the study of the earliest phases of star and planet formation. It is believed that the formation of stars and planetary systems begins with minor density concentration in the interstellar medium and accelerates through successive stages of collapse and fragmentation, ending with the emergence of a newly-formed star out of the cocoon of dust and gas within which it was born. This condensation and collapse is thought to occur within dense clouds which are impenetrable to optical and ultraviolet radiation, but can be penetrated by infrared observations. In addition, particularly in the earliest stages of collapse, the protosteller (before the formation of a star) material is at such low temperatures that it radiates only in the infrared. SIRTF would be able to study protostars and their environments at all evolutionary stages, and SIRTF's large arrays would enable rapid surveys of large star-forming regions to provide an unbiased assessment of the number and properties of the newly forming stars. Of particular importance would be searches for evidence of circumstellar disks within which planets may be forming.

Even when the process of planetary formation is completed, it may leave behind a tenuous planetary debris disk that is replenished by continued collisions among cometary- and asteroid-sized objects. The discovery of such solar system-sized debris disks – visible by their infrared radiation – around nearby solar-type stars was one of the principal accomplishments of SIRTF's predecessor mission, IRAS. SIRTF could study these systems in detail, providing images that may delineate the central, dust-free regions inferred from IRAS' observations. It has been suggested that these central voids signal the presence of planetary bodies that may be sweeping up the interplanetary dust. SIRTF could also explore the possible connection between these debris disks around nearby stars and the structure in our own solar system beyond the orbit of Neptune, which is known as the Kuiper Belt, the reservoir of short-period comets. SIRTF's spectrographs would compare the composition of the dust in extra-solar debris disks with that of the dust in newly discovered Kuiper Belt comets. The amount of dust to be found in the Kuiper Belt appears to be orders of magnitude less than is associated with the most prominent debris disks found by IRAS, but SIRTF would have the sensitivity to image a disk orbiting the nearest solar-type stars, even if it is as tenuous as the Kuiper Belt.

2.1.2.3 Study Ultraluminous Galaxies and Active Galactic Nuclei

Understanding Active Galactic Nuclei (AGN) has been a major thrust of modern astrophysics for three decades. AGN are very compact, very luminous extragalactic objects containing highly excited gas that exhibits high velocity motions. Infrared luminous AGN have been known since the early 1970s, and it was shown at that time that many AGN emitted the bulk of their luminosity at IR wavelengths. These objects test our physical understanding because their high luminosities cannot be sustained by the normal processes of stellar energy generation. It is generally thought that AGN are powered by the gravitational energy released as matter condenses onto massive blackholes, but many details of this picture remain uncertain.

The SIRTF Observatory would be a unique observatory to explore infrared luminous galaxies over 90% of the age of the universe, and would clarify the relation of these systems to AGN discovered via other techniques, as well as address the deeper question of the relation of AGN to the evolution of galaxies in general. A deep survey undertaken by SIRTF would provide large databases of targets for detailed studies. It could also provide data for statistical analyses of the evolution of infrared bright galaxies. The multi-wavelength aspect of these surveys could provide a powerful way to select the most distant and luminous infrared bright galaxies for further study by SIRTF. The spectroscopic capability of SIRTF could permit the determination of redshifts (the shifting of visible and ultraviolet radiation from a receding object into infrared due to the familiar Doppler effect), and hence the luminosities of the most extreme systems discovered. In addition, the SIRTF spectrograph would be able to probe the centers of dust-enshrouded nuclei, and thereby determine the nature of the excitation of these systems and their underlying power sources. Because SIRTF could detect these objects at truly cosmological distances, these investigations would explore not only the character of the infrared luminous galaxies but also the early history of the Universe.

2.1.2.4 Study the Early Universe

SIRTF would allow us to explore the distant past. The expansion of the Universe means that more distant objects are moving away at higher velocities, and the finite speed of light implies that we see more distant objects as they were at earlier times. The speed of recession creates the redshift. As a result of this redshift. infrared observations can probe the past by studying starlight from very distant – and very young – galaxies. SIRTF would be used to carry out an ultra-deep survey of a small region of the sky with the aim of detecting galaxies as they appeared when the Universe was about one-tenth of its present age. The observations would be carried out simultaneously at several near-infrared wavelengths to obtain the galaxies' spectra, which would permit a determination of their distances and hence their true luminosities. This survey could provide the data necessary to test current models of the formation and evolution of galaxies.

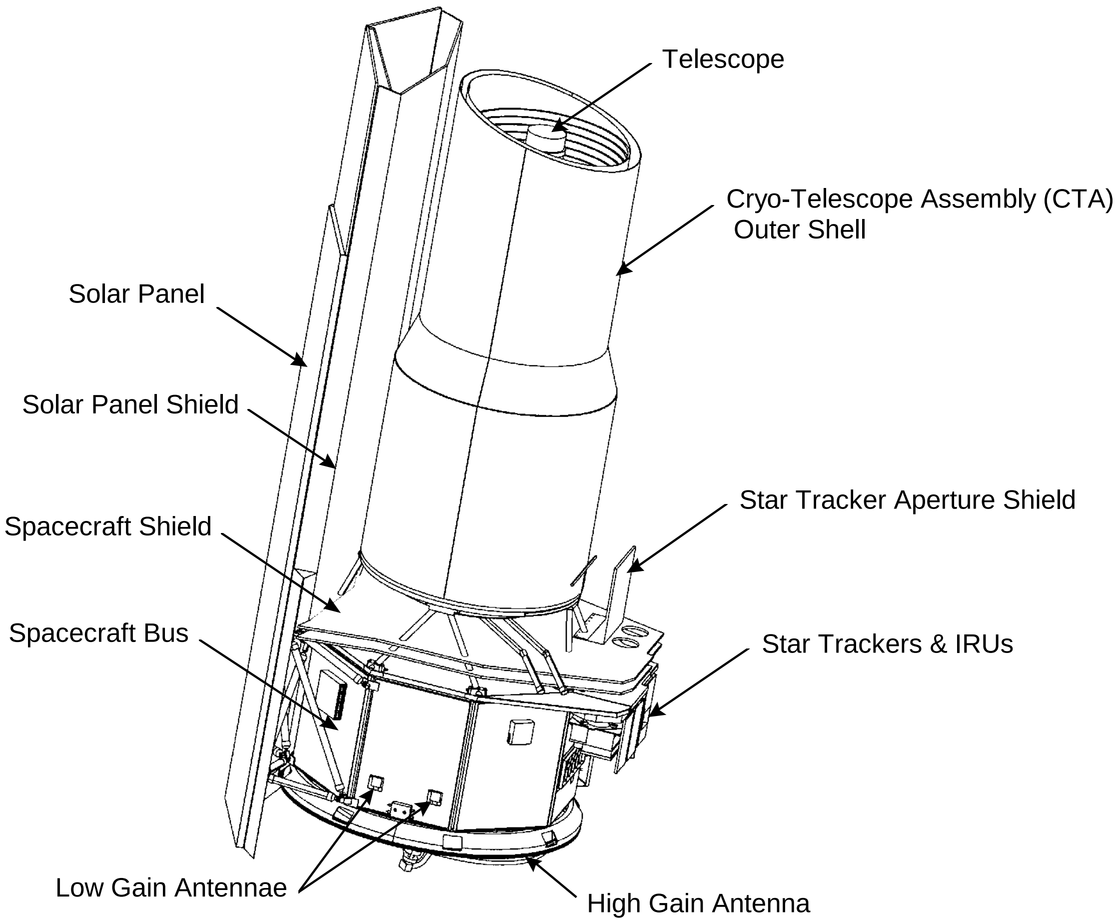
This area is one of many in which SIRTF's scientific programs could overlap those of the other Great Observatories, particularly HST and Chandra. In this case, the recently completed HST deep-field survey contains many distant galaxies that would appear in SIRTF's deep images of the same field. Comparing infrared (SIRTF) and visible (HST) data on these galaxies would provide important insights into galaxy evolution and would establish a context for the interpretation of the data on more distant galaxies that might be seen only by SIRTF.

2.1.3 SIRTF Observatory Description

The proposed SIRTF Observatory flight configuration is shown in Figure 2-2. It would consist of five primary elements: the Cryo-Telescope Assembly (CTA), the Spacecraft (S/C), the Infrared Array Camera (IRAC), the Infrared Spectrograph (IRS), and the Multiband Imaging Photometer for SIRTF (MIPS). These elements are summarized in the following paragraphs.

The Cryo-Telescope Assembly (CTA) would consist of a Cassegrain telescope, housed inside the CTA shell. The CTA would be protected from direct exposure from the Sun by a solar panel and a solar panel shield. The instruments would be housed inside the Multiple Instrument Chamber (MIC) directly behind the primary mirror of the telescope. The helium tank would be below the MIC. The helium tank and the MIC would be housed inside the cryostat vacuum shell. The cold CTA would be thermally isolated from the warm spacecraft by the CTA support truss and the spacecraft shield.

The spacecraft bus would be attached to the bottom of the CTA and would contain the usual spacecraft subsystems: telecommunications, reaction control, pointing control, command and data handling, and power. The star tracker and gyro package would be mounted on the



Source: [CIT 2000]

Figure 2-2 SIRTF Observatory

spacecraft bus. The high gain antenna would be located at the aft end of the spacecraft bus. Reaction control system thrusters (used to de-saturate the reaction wheels) would be located on outriggers from the spacecraft bus.

The three science instruments each would consist of a cold assembly mounted in the MIC in the cryostat, and warm electronics mounted on the spacecraft bus.

2.1.3.1 Infrared Array Camera (IRAC)

The IRAC would be a four-channel imager packaged in a single module. Simultaneous wide-field images at 3.5, 4.5, 6.3, and 8.0 µm (1.4×10^{-4}, 1.8×10^{-4}, 2.5×10^{-4}, 3.1×10^{-4} in) would be possible with 25 percent bandwidth at each wavelength. Each channel would have 5.1x5.1 arc-minute field of view and a 256x256 detector array. The IRAC works like a digital camera, except it takes pictures in the IR.

2.1.3.2 Multi-band Infrared Photometer for SIRTF (MIPS)

The MIPS instrument would comprise of a single cold optical module which would contain five distinct optical trains that could be operated in one of three data gathering modes: One mode would be to image simultaneously at 24, 70, and 160 µm (9.4x10^{-4}, 2.8x10^{-3}, 6.3x10^{-3} in) bands using 128x128, 32x32, and 20x2 detector arrays, respectively. The second mode would be to image with high magnification at 70 µm (2.8x10^{-3} in) using the 32x32 array. The third mode would be to obtain low-resolution spectroscopy from 50 to 100 µm (2.0x10^{-3} to 3.9x10^{-3} in) using the 32x32 array. A single axis scan mechanism would be included to modulate the signal on the detectors to provide good photometric performance, and to select among the three instrument operating modes. The MIPS works like a digital camera covering longer IR wavelengths than the IRAC.

2.1.3.3 Infrared Spectrograph (IRS)

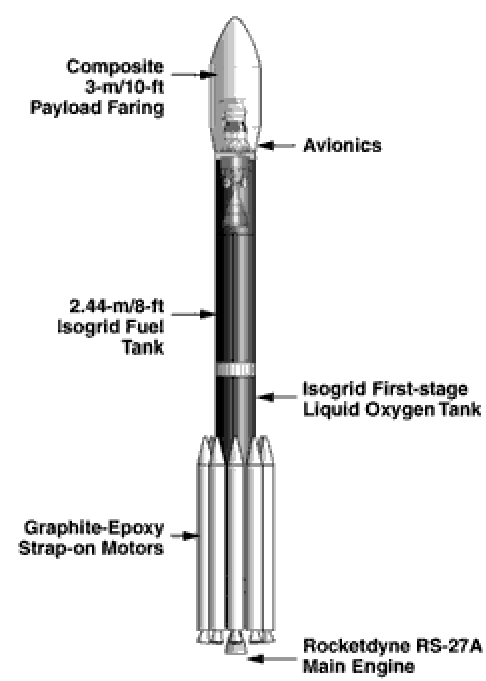
The IRS would be comprised of four separate cold optical modules that would be independent of each other both optically and mechanically. Two of the modules would produce low-resolution spectra with a one-dimensional image along the slit. The other two produce two-dimensional moderate resolution spectra with 7 to 10 spectral orders on the array. Each module would use a 128x128 detector array. The IRS would cover the spectral range from 5 to 40 µm (2.0x10^{-4} to 1.6x10^{-3} in). The IRS is a spectrograph and detects absorption and emission lines of observed objects, which allow the study of the elemental composition of the material that makes up the objects.

2.1.4 Launch Vehicle

The Delta II 7920H is the baseline launch vehicle for the SIRTF mission. The Delta II 7920H launch vehicle (Figure 2-3) consists of a payload fairing and the first and second stage propulsion systems with nine Alliant large diameter extended length (LDXL) graphite epoxy motors (GEMs) used as strap-on boosters to the first stage. [USAF 1994, 1996]

2.1.4.1 Payload Fairing

During ascent, the SIRTF Observatory would be protected from aerodynamic forces by a 2.9 m (9.5 ft) payload fairing (PLF). The PLF would be jettisoned from the launch vehicle during second stage-powered flight at an altitude of at least 111 km (69 mi). Figure 2-4 shows the launch configuration of the SIRTF Observatory inside the fairing.



Source: [Boeing 2001]

Figure 2-3 Delta II 7920H

2.1.4.2 Delta II First and Second Stage

The first stage of the Delta II is powered by a liquid bipropellant main engine and two vernier engines. The first stage propellant load consists of approximately 96,243 kg (211,735 lb) of RP-1 fuel (thermally stable kerosene) and liquid oxygen as an oxidizer. First stage thrust is augmented by nine LDXL GEMs, each fueled with 16,738 kg (36,900 lb) of Hydroxyl-Terminated PolyButediene (HTPB) solid propellant. [USAF 1994] The main engine, vernier engines, and six of the GEMs are ignited at liftoff. The remaining three GEMs are ignited in flight. The GEMs are jettisoned after burnout of the solid propellant.

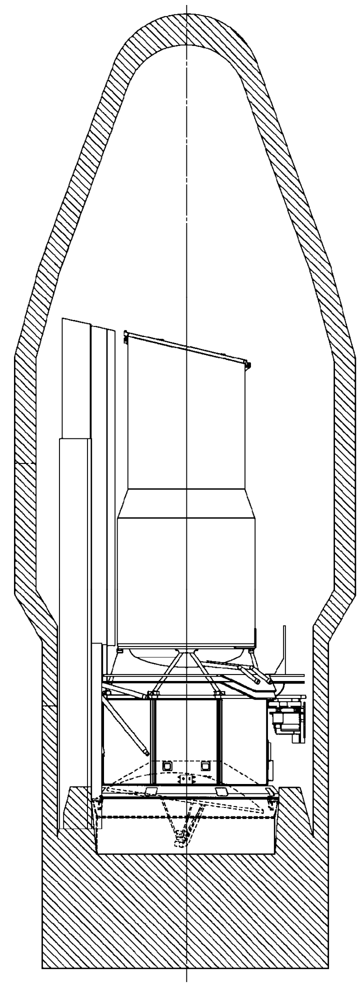


Figure 2-4 SIRTF Launch Configuration Inside the Delta II 7920H Payload Fairing

Source: [JPL 2000]

The Delta II second stage propulsion system has a bipropellant engine that uses Aerozine 50 (a 50/50 mix of hydrazine and unsymmetrical dimethyl hydrazine (UDMH)) as fuel and nitrogen tetroxide (N_2O_4) as oxidizer. The second stage has a total propellant load of 6,019 kg (13,242 lb). [USAF 1994]

2.1.4.3 Flight Termination System

The Eastern Range (ER) Range Safety Office has the responsibility for establishing flight safety limits for the trajectory of a launch vehicle. These limits are defined to ensure that errant launch vehicles (or debris resulting from a launch failure) would not pose a danger to human life or property. These flight safety limits are determined before launch, using predicted values of winds, explosively produced fragment sizes and velocities, human reaction time, transmission delay time, and other pertinent data. During a launch, if the vehicle trajectory indicates that these limits would be exceeded, the ER Mission Flight Control Officer would take appropriate action, including destruction of the vehicle. [EWR 127-1]

As specified by Range Safety requirements, the SIRTF Observatory launch vehicle would be equipped with a Flight Termination System (FTS). This system would be capable of destroying the vehicle based on commands sent from the ER Mission Flight Control Officer. In the event of an unplanned separation of the first and second stages, the FTS would automatically issue a destruct command. This function would be activated when electrical paths between stages are interrupted and stage separation commands have not been issued by the flight computer.

An electromechanical Safe and Arm (S&A) device would be located on each of the first and second stages. Upon activation of the FTS, either by a Range Safety destruct command or by sensing vehicle breakup, the S&A device would enable the power and sequence box to trigger the destruction of the vehicle. The first stage S&A device would be connected to several strands of explosive detonating cord, which is attached to the propellant tanks. When activated, these detonations would rupture the tanks, initiating the rapid burning and dispersion of propellants before the vehicle impacts the ground. The second stage S&A device would be connected to a linear shape charge designed to sever the second stage propellant tanks. [MDSSC 1991]

2.1.4.4 Launch Vehicle Debris

Delta launch vehicles use containment devices to mitigate the spread of debris generated during staging operations. Once separated, the Delta II payload fairing, first stage, and GEMs do not achieve Earth orbit. After burnout, the GEMs fall into the Coast Guard-controlled area of the Atlantic Ocean. The first stage burns to depletion to avoid potential tank rupture and breakup from over-pressurization caused by solar heating, then falls into the Atlantic Ocean. The SIRTF Observatory and the second stage would reach escape velocity at about 40 minutes into the flight. The SIRTF Project has followed the NASA guidelines regarding orbital debris and limiting the risk of human casualty for uncontrolled reentry into the Earth's atmosphere. [NASA 1995-A, NASA 1997-B] An Orbital Debris Assessment report has been submitted. [JPL 2000] The NASA Office of Space Science and the JSC Orbital Debris program office have reviewed the report and have concurred with the assessment.

2.1.5 Cape Canaveral Air Force Station (CCAFS) Operations

Delta launches have occurred from CCAFS Launch Complex 17 (LC-17) since May of 1960, with a reliability of greater than 93 percent. During this long period of federally sponsored activities, launch preparation procedures have been well documented, standardized, and continuously reviewed. SIRTF launch personnel would be trained to follow established procedures.

Safe hardware and support equipment would be used to ensure safety for both personnel and equipment during all phases of fabrication, test, and operation. The SIRTF project would prepare a Mission Assurance and Safety Plan and a Missile System Pre-Launch Safety Package (MSPSP) in accordance with JPL, Kennedy Space Center (KSC), and Air Force Eastern and Western Range Safety Requirements (EWR 127-1). A Safety Review Panel (SRP) high-performance work team, as specified by EWR 127-1, would be convened and meet as required to review and guide the resolution of safety issues.

2.1.5.1 Launch Vehicle Processing

The Delta II first and second stages would be initially received, inspected, and stored at Hangar M (Figure 2-5). They would then be moved to the Delta Mission Check-Out (DMCO) in Building AO for hardware integration and systems testing. The first stage would then be transferred to the Delta Spin Test Facility for installation of the destruct ordnance package, and prepared for erection at the launch site. The second stage would depart DMCO for the Area 55 Second Stage Check-Out building for verification of hydraulic and propulsion systems and destruct ordnance package installation. Both the first and second stages would then be transported to the launch pad for integration and testing. The GEM solid rocket motors would receive all prelaunch processing in the Solid Motor Buildup Area 57 before being transported to the LC-17 launch pad and attached to the first stage. [USAF 1994, 1996]

2.1.5.2 SIRTF Observatory Processing

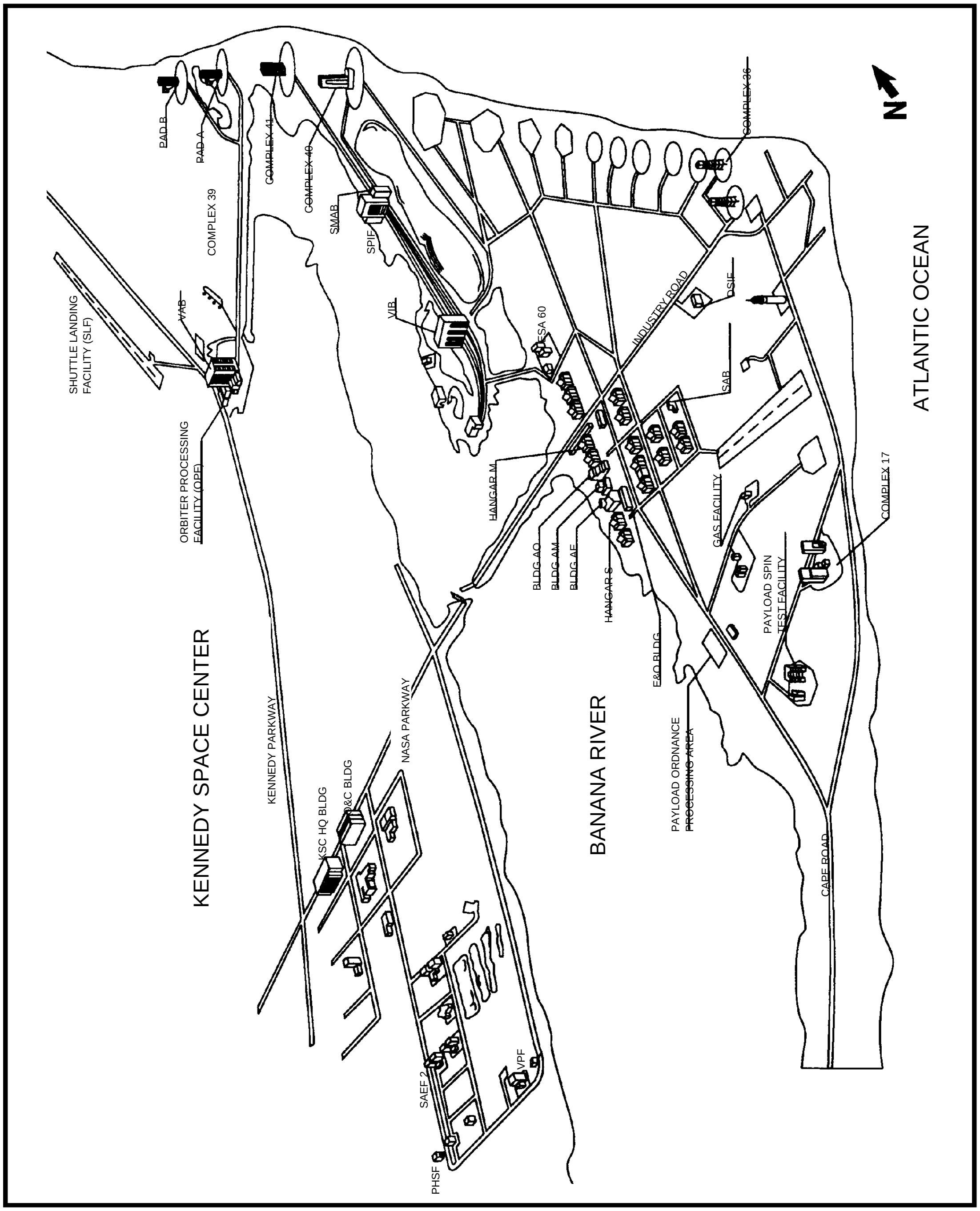
The activities associated with completing the preparations of the SIRTF Observatory primarily involve fabricating the Cryo-Telescope Assembly (CTA) at Ball Aerospace and Technology Corp (BATC) in Boulder, Colorado, and the spacecraft at Lockheed Martin Space System (LMSS) at Sunnyvale, California. The final assembly of the CTA and spacecraft to complete the SIRTF Observatory would occur at LMSS. While such fabrication activities may generate small quantities of effluents normally associated with tooling or cleaning operations, these would be well within the scope of normal activities at the fabrication/testing facilities and will produce no substantial adverse environmental consequences.

2.1.5.2.1 SIRTF Observatory Integration and Test Operations

The SIRTF Observatory, in an environmental controlled shipping container, would be transported via truck from Lockheed Martin Space System (LMSS), Sunnyvale CA, and arrive at building AE. At building AE, the component systems and subsystems would undergo testing to verify proper operation prior to transport to the launch pad. The following major component assembly activities would occur in building AE:

- Electronic ground support equipment check-out
- System test complex check-out
- SIRTF Observatory baseline test to ensure that power, telemetry, science systems, etc., were not damaged in shipping

The SIRTF Observatory would be transferred to CCAFS LC-17 via the Boeing Payload Transport Trailer, mated to the Delta launch vehicle, and final integrated tests with the launch vehicle would be conducted in preparation for the launch.



Source: [NASA 2000-B]

Figure 2-5 Launch Vehicle and Spacecraft Processing Areas, KSC/CCAFS

2.1.5.2.2 Pad Activities

The SIRTF Observatory would arrive at the base of the pad, be hoisted to the top of the launch tower payload level, and mated to the launch vehicle. Once mated to the launch vehicle, interface verifications with the launch vehicle, launch rehearsals, and power on/off stray voltage checks would be performed to verify Observatory compatibility with the launch vehicle.

Integrated operations at the pad would also include:

- The SIRTF Observatory structure would be electrically mated to the Delta II 7920H launch vehicle.
- Final Observatory functional tests would be performed.

2.2 OTHER ALTERNATIVES

Alternatives to the proposed action that were considered included those that: (1) utilize an alternate launch vehicle, (2) utilize an alternate launch site, and (3) cancel the SIRTF mission (the No-Action alternative).

2.2.1 Alternate Launch Vehicles

2.2.1.1 Selection Criteria

Selecting a launch vehicle for a deep space mission largely depends on matching the payload mass and the energy required to achieve the desired trajectory to the capabilities of the prospective launch vehicle. The more massive the payload and the more energy required to achieve the trajectory, the more powerful the LV required. The most desirable LV would meet, but would not greatly exceed, the mission's minimum launch performance requirements.

For the SIRTF mission, constraints on LV performance are the SIRTF launch mass of approximately 930 kg (2,050 lb) and an injection energy (C_3) of 0.4 km^2/sec^2. Other considerations that must be addressed in selection of the LV include reliability, cost, and potential environmental impacts associated with use of the LV.

Feasible alternative LVs for SIRTF are potentially available from both foreign and domestic manufacturers. Potential alternative LVs from foreign manufacturers include the European Space Agency (ESA) Ariane and the Russian Proton. Potential alternative U.S. launch systems include the Space Transportation System (STS) and various Atlas, Delta, and Titan configurations.

2.2.1.2 Foreign Launch Vehicles

Of the foreign LVs that are potentially available for the SIRTF mission, the ESA Ariane 44L and the Russian Proton most closely match the SIRTF requirements for performance and injection energy. However, both of these vehicles exceed by a wide margin the SIRTF mission requirements. Therefore, these foreign launch systems are not considered to be reasonable alternatives.

2.2.1.3 U.S. Launch Vehicles

2.2.1.3.1 Space Transportation System

The STS greatly exceeds the SIRTF mission requirements and would not be considered a reasonable alternative launch vehicle.

2.2.1.3.2 U.S. Expendable Launch Vehicles

Among U.S. expendable launch vehicles, the Atlas II and Delta III are the closest to meeting SIRTF requirements. [Boeing 2001, LMSSC 2001]

The Atlas II launch vehicle has a booster section consisting of two liquid oxygen/kerosene booster engines, which feed the sustainer section propellant tanks. The sustainer section fuel tank contains approximately 48,988 kg (108,000 lb) of kerosene (RP-1) as compared to the 30,229 kg (66,504 lb) [USAF 1994] contained by the Delta II first stage. [AIAA 1995] The launch vehicle exhaust effluents are distributed along the trajectory for both launch vehicles. Due to it's larger mass, the Atlas II launch vehicle accelerates off the launch pad more slowly than the Delta II 7920H, and thus, more of its exhaust products are ejected into the lower atmosphere. The Atlas II would contribute less potential environmental impacts than the Delta II 7920H because it does not have the solid rocket boosters, but it exceeds the launch capability of the Delta II 7920H by approximately 1000 kg, and would cost about 80% more than the Delta II 7920H. The additional cost of the Atlas II launch vehicle would preclude launching the cost-constrained SIRTF mission.

The Delta III is a new vehicle. The first two flights ended in failures; the third flight was considered a success. It provides 2700 kg of mass performance, almost three times more than what is needed to launch the SIRTF Observatory. It costs about 60% more than the Delta II 7920H. It uses the same solid motors as the Delta II 7920H. The Delta III first stage liquid propellants (RP-1 and liquid oxygen) are identical in design and quantity to the first stage of the Delta II 7920H. The Delta III second stage uses liquid hydrogen and oxygen. Consequently, it has approximately the same environmental impact as the Delta II 7920H. Since the Delta II 7920H has sufficient performance for the SIRTF Observatory, there is no reason to incur the additional cost and risk of using the new Delta III.

The Titan IV is a heavy lift vehicle. It provides 9500 kg (20,947 lb) of mass performance for SIRTF, almost ten times more than what is needed. The cost is about eight times more than the Delta II 7920H. It is not a reasonable alternative vehicle for the SIRTF mission.

2.2.1.4 Summary

Of the launch systems examined, the Delta II 7920H is the best suited for the SIRTF mission, for the reasons listed below:

- The mass performance of the Delta II 7920H most closely matches the SIRTF performance requirement.
- The Delta II 7920H is the more reliable alternative launch vehicle of those systems meeting the SIRTF mission performance criteria.
- The Delta II 7920H is the lowest cost alternative launch vehicle of those meeting the performance criteria.

- Of the reasonable alternative launch vehicles examined, all were approximately equal in their potential environmental impacts. [DOT 1986]

2.2.2 Launch Sites

CCAFS and Vandenberg Air Force Base (VAFB) have the only currently approved facilities to launch Delta II launch vehicles. Since the Delta II is the preferred launch vehicle for the SIRTF mission, alternate launch sites to CCAFS and VAFB would not be available. There have historically been approximately eight to twelve Delta II launches per year for the past ten years.

The direction of launch, commonly referred to as flight azimuth, depends on range safety considerations that prohibit flying over certain land and ocean areas. Flights from VAFB must launch west and south to avoid overflying the heavily populated West Coast. This means that the launch vehicle is moving in the direction opposite to Earth's rotation. Launches from CCAFS are toward the east and in the direction of Earth's rotation, and thus do not require the extra fuel to achieve the same orbit as those originating from VAFB. Therefore, a larger launch vehicle would be required to launch SIRTF onto the same trajectory from VAFB.

2.2.3 No-Action Alternative

The No-Action alternative would result in termination of the mission, which would disrupt the progress of NASA's Great Observatory and Origins Programs. The SIRTF mission is the culmination of more than a decade's planning to extend our knowledge of our solar system, our galaxy, and the Universe. The No-Action alternative would eliminate or delay the acquisition of scientific knowledge of our solar system, our galaxy, and the Universe. In preparation for the SIRTF mission, the infrared astronomical community and NASA have invested more than ten years of technology development in infrared detectors. The No-Action alternative would prevent the application of these large format IR detectors in the advancement of science. The No-Action alternative would also delay or prevent the validation of technologies critical to future astrophysical missions. These technological areas include the use of lightweight mirror, the warm launch architecture, the Earth escape orbit without the need of a propulsion system, and the high data-rate deep space communication. While some environmental impact would be avoided by cancellation of the single launch, the loss of the scientific knowledge and database that could lead to future technological advances could be significant.

SECTION 3
AFFECTED ENVIRONMENT

Cape Canaveral Air Force Station (CCAFS) accommodates various ongoing space programs and is managed for the United States Air Force (USAF) by Patrick Air Force Base (PAFB). The cumulative environmental effects associated with these programs have been included in the baseline environmental conditions, which are detailed in the following sections. The information provided in this section is summarized from the reference documents cited in the text. Refer to those references for more complete information and maps of environmental resources, as well as for discussion of required permits and facilities issues.

3.1 REGIONAL AND LOCAL ENVIRONMENT

For the purposes of this document, the region of interest (Figure 3-1) consists of the six county area of Volusia, Seminole, Lake, Orange, Osceola, and Brevard counties.

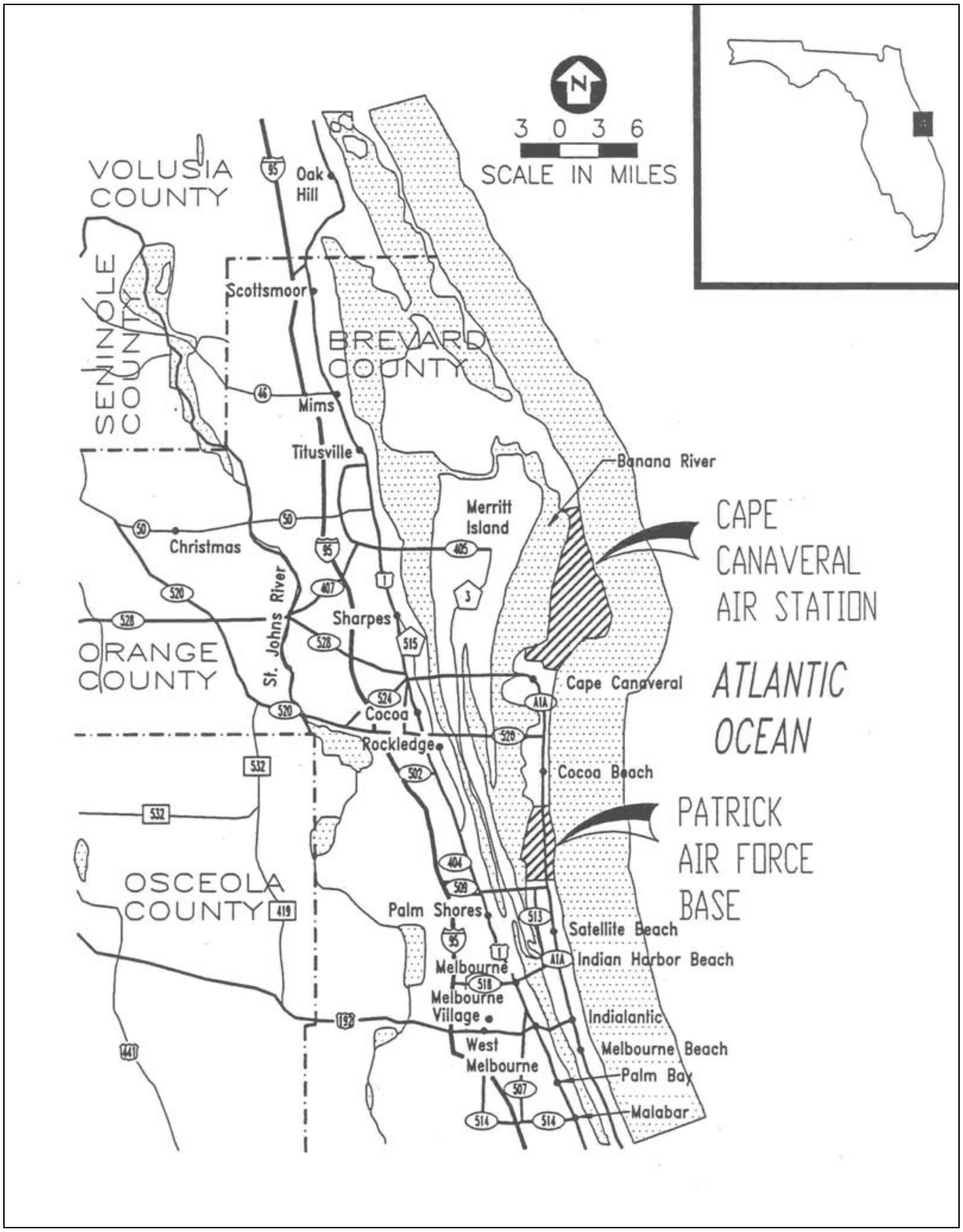
CCAFS is located in Brevard County on the east coast of Florida, near the city of Cocoa Beach and 75 km (45 mi) east of Orlando. The station occupies nearly 65 square (sq) km (25 sq mi) of the barrier island that contains Cape Canaveral, and is adjacent to the NASA Kennedy Space Center (KSC), Merritt Island, Florida. CCAFS is bounded by KSC on the north, the Atlantic Ocean on the east, the city of Cape Canaveral on the south, and the Banana River and KSC/Merritt Island National Wildlife Refuge on the west (Figure 3-2).

3.1.1 Population and Economics

Prior to 1950 the population of Brevard County was predominantly rural. Activation of the CCAFS in the 1950s brought military personnel into the county. For the last forty years, the population and economy of Brevard County has been closely linked to the growth of the space program. There was a constant influx of aerospace contractors and military personnel from the early 1950s through the mid-1960s. Employment levels dropped in the late-1960s, reflecting major cutbacks in NASA operations. The local aerospace economy recovered after 1979 due to a renewed national emphasis on launch activities. [Census 2001]

CCAFS has a work force of approximately 7,500 people, most of whom are employed by companies involved in launch vehicle testing and space launch operation. About 95 percent of the installation's military and civilian contractor personnel live in Brevard County, with the remainder residing in the surrounding counties. Major urban centers includes Titusville (20 km [12 mi] northwest, population 40,670), Cocoa (12 km [7 mi] southwest, population 16,412), Melbourne (48 km [30 mi], population 71,382), and Cape Canaveral (0.8 km [0.5 mi] south, population 8,829). The nearest significant residential areas are Cocoa Beach (13 km [8 mi] south, population 12,482), and Merritt Island (population 36,090). All military personnel serving at the station are assigned to Patrick Air Force Base (PAFB), about 25 km (15 mi) to the south of CCAFS. [USAF 2000]

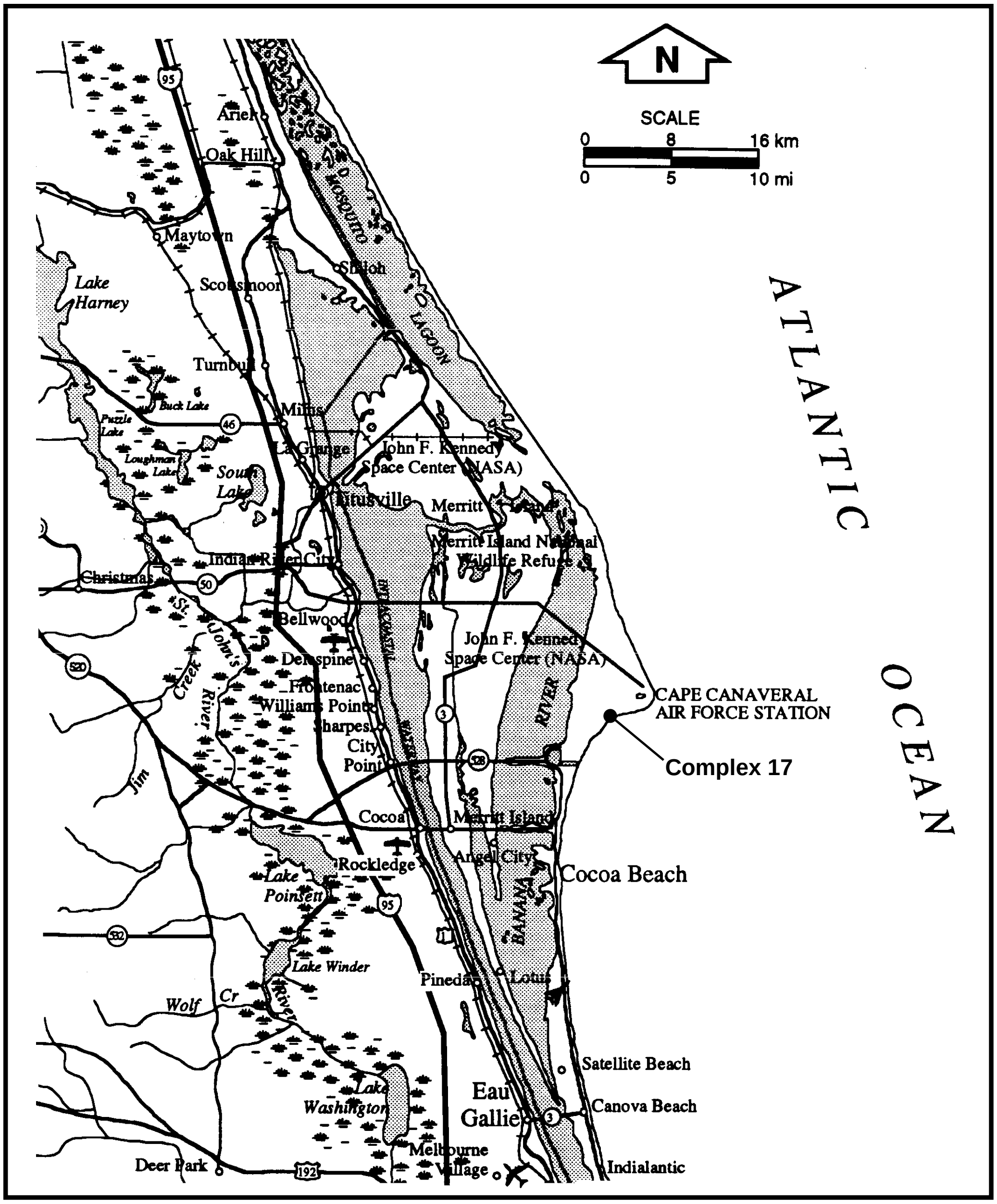
In the 2000 census, Brevard County's population was 476,230. The population growth for Brevard County has been projected to be 511,100 by the year 2005. [ECFRPC 2001] The greatest increase is expected to occur in southern Brevard County and the lowest in the central portion of the county. Economic sectors providing significant employment include services, with 58,800 employees (34.6 percent of total non-agricultural employment); retail trade, with 34,400



Source: [USAF 1996]

Figure 3-1 Regional Area of Interest

(20.3 percent); government, with 25,300 (14.9 percent); manufacturing, with 28,400 (16.7 percent); construction, with 8,200 (4.8 percent); finance and real estate, with 5,700 (3.4 percent); wholesale trade, with 4,200 (2.5 percent); and transportation and public utilities, with 4,800 (2.8 percent). [ECFRPC 1995] In addition to resident employees, many people commute from surrounding areas to work in the county.



Source: [USAF 1996]

Figure 3-2. Location of CCAFS Relative to the Region of Interest

At the beginning of 1999, 1,452,147 people were employed in the region. A total of 958,874 people were employed in Orange, Seminole, and Osceola Counties, 234,335 in Brevard, 175,023 in Volusia, and 83,915 in Lake. The unemployment rate for the region at the beginning of 2001 was 3.6 percent. Workers in the Melbourne-Titusville-Palm Bay metropolitan area averaged $15.65 per hour during November 2000, according to a survey released by the U.S. Department of Labor's Bureau of Labor Statistics. The regional commissioner reported that white-collar workers averaged $18.71 per hour and accounted for 58 percent of the workers in the area. Blue-collar employees averaged $13.35 per hour and represented 20 percent of the workforce, while the remaining 22 percent worked in service occupations and earned $9.21 per hour. [BLS 2001] At the nearest uncontrolled population area (16 km [10 mi]) from the launch complexes, the median income was $32,289. [EDC 2001]

Adapted from the 2000 Census of Population and Housing, within 100 km (62 mi) area around the CCAFS launch site, the 2000 population was approximately 2.6 million. About 61,308 people resided within 20 km (12 mi) of the launch site, and about 21,311 live within a distance of 10 km (6 mi). The population within 100 km (62 mi) of the launch site is expected to grow to over 3 million by 2005. Similarly, the population within 20 km (12 mi) is expected to grow to over 70,000 by 2005. By 2005 the population within 10 km (6 mi) is expected to grow to over 24,000. [ECFRPC 2001]

In 2000, minority representation within 100 km (62 mi) of the launch site was approximately 16 percent of the total population and is expected to grow to about 24 percent in 2005. Black residents constituted over half the minority population in 2000 with Hispanic residents constituting about one-third. As the general population grows through 2005, Black and Hispanic residents are expected to dominate the minority populations, with the Hispanic segment growing to almost 50 percent of the minority population and Black representation declining to about 40 percent. Within a distance of 20 km (12 mi) of the launch site, minorities accounted for approximately twelve percent of the 2000 population with Black residents accounting for more than half the minority population and Hispanics accounting for about thirty percent. Blacks and Hispanics in almost equal proportions are expected to constitute over eighty percent of the minority population by 2005. [Adapted from Census 2001]

Within 10 km (6 mi) of the launch site, minority groups constituted about eleven percent of the total population, and are expected to increase to about 14 percent in 2005. Within 10 km (6 mi) Black and Hispanic residents accounted for about seventy percent of the minority populations in 2000, and this trend is expected to remain the same until 2005. [Adapted from Census 2001]

In 2000 about eleven percent of the population within 100 km (62 mi) of CCAFS were below the 2000 income poverty threshold. Within 20 km (12 mi) about eight percent of the residents were below the threshold, and about eleven percent within a 10 km (6 mi) area were below the threshold. [ECFRPC 2001]

3.1.2 Land Use

Only about 8 percent, or 1,327.42 sq km (510 sq mi), of the total region (17,000 sq km; 6,534.8 sq mi) is urbanized [ECFRPC 1992], with the largest concentrations of people occurring in three metropolitan areas:

- Orlando, in Orange County, expanding into the Lake Mary and Sanford areas of Seminole County to the north, and into the Kissimmee and St. Cloud areas of Osceola County to the south,

- the coastal area of Volusia County, including Daytona Beach, Port Orange, Ormond Beach, and New Smyrna Beach, and,
- along the Indian River Lagoon and coastal areas of Brevard County, specifically the cities of Titusville, Melbourne, and Palm Bay.

Approximately 85 percent of the region's population lives in urban areas.

The majority of the region is considered rural, which includes agricultural lands and their associated trade and service areas, conservation and recreation lands, and undeveloped areas. About 35 percent of the regional area is devoted to agriculture, including more than 5,000 farms, nurseries, and ranches. Agricultural areas include citrus groves, winter vegetable farms, pasture land and livestock, foliage nurseries, sod farms, and dairy land.

Approximately 30 percent of the CCAFS (about 18.8 sq km; 7.3 sq mi) is developed, and consists of launch complexes and support facilities. The remaining 70 percent is comprised of unimproved land. CCAFS also contains a small industrial area, the Air Force Space Museum, a turning basin for the docking of submarines, and an airstrip that was initially constructed for research and development in recovery operations for missile launches. Many of the hangars located on the station are used for missile assembly and testing. Future land use patterns are expected to remain similar to current conditions. KSC occupies almost 560 sq km (216 sq mi), about 5 percent of which is developed land. Nearly 40 percent of the KSC consists of open water areas, such as portions of the Indian and Banana Rivers, Mosquito Lagoon, and all of Banana Creek. [USAF 1996]

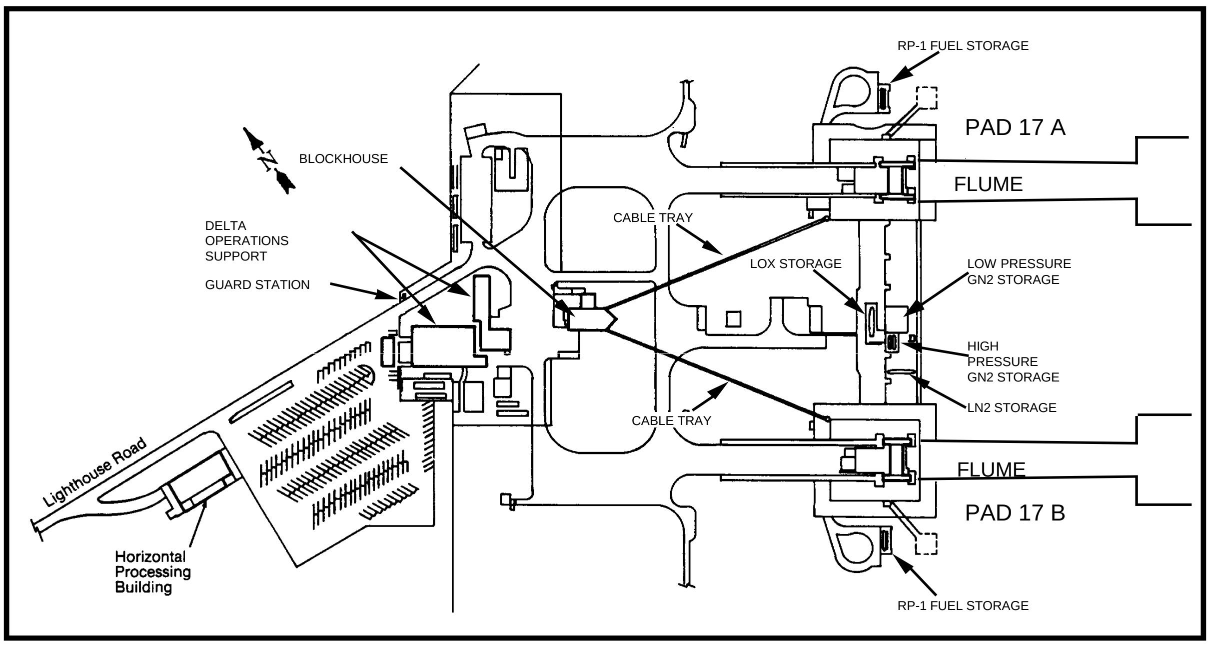
LC-17 (Figure 3-3) is located in the southern portion of CCAFS, approximately 0.8 km (0.5 mi) west of the Atlantic Ocean, 2.5 km (1.5 mi) east of the Banana River, and roughly 5.7 km (3.4 mi) from the station's South Gate. The complex consists of two launch pads, 17A and 17B, each with its own mobile Missile Service Tower, Fixed Umbilical Tower, cable runs, and Fuel Storage Area. [USAF 1994]

A concrete exhaust flume on each pad deflects exhaust gases away from the pad to reduce the noise and shock wave that result from ignition of solid rockets and the first stage of the launch vehicle.

The two launch pads share common gas storage facilities, located in bunkers between the pads, and are monitored from a common blockhouse, located at a distance from the launch pads. Other miscellaneous support and service facilities are shared between them, as well. LC-17 was renovated in the late 1980s to support an upgraded version of the Delta launch vehicle.

3.1.3 Economic Base

The region's economic base is tourism and manufacturing. Tourism-related employment includes most jobs in amusement parks, hotels, motels, and campgrounds, as well as many occupations in the retail trade and various types of services. Manufacturing jobs, while probably outnumbered by tourism jobs, may provide more monetary benefits to the region because of higher average wages and a larger multiplier effect. Between 1994 and 1997, the rate of annual county job growth averaged 2.9 percent. [USAF 1998]



Source: [USAF 1996]

Figure 3-3. Launch Complex 17

The region's agricultural activities include citrus groves, winter vegetable farms, pastures, foliage nurseries, sod, livestock, and dairy production. In the central region, 30 percent of the land is forested and supports silviculture, including harvesting of yellow pine, cypress, sweetgum, maple, and bay trees. In Osceola County, large cattle ranches occupy almost all of the rural land. Agricultural employment declined in 1986 to just 2.2 percent of the region's employment base.

Commercial fisheries in the two counties bordering the ocean (Brevard and Volusia) landed a total of approximately 6,230 metric tons (about 13.7 million pounds) of finfish, shrimp and other invertebrates in 1997. Brevard County ranked third among the East Coast counties of Florida in total 1997 finfish landings. [FDEP 2001]

3.1.4 Environmental Justice

Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," focuses Federal attention on the environmental and human health conditions in minority communities and low-income communities. The NASA Environmental Justice Strategy requires the identification and consideration of disproportionately high and adverse human health or environmental effects of NASA programs on minority populations and low-income populations. Accompanying EO 12898 was a Presidential Transmittal Memorandum that referenced existing federal statutes and regulations to be used in conjunction with EO 12898. The memorandum addressed the use of the policies and procedures of the NEPA. Specifically, the memorandum indicates that, "Each Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the NEPA 42 U.S.C. Section 4321, et seq." Although an environmental justice analysis is not mandated by NEPA, NASA has directed that NEPA will be used as the primary approach to implement the provision of the EO.

Although EO 12898 provides no guidelines as to how to determine concentrations of minority or low-income populations, the demographic analysis provides information on the approximate locations of minority and low-income populations in the area potentially affected by the Delta launch program at CCAFS.

The 2000 Census of Population and Housing reports numbers of both minority and poverty residents. Minority populations included in the census are identified as Black; American Indian, Eskimo, or Aleut; Asian or Pacific Islander; Hispanic; or Other. Poverty status (used in this EA to define low-income status) is reported as the number of families with income below poverty level ($17,029 for a family of four in 1999, as reported in the 2000 Census of Population and Housing). [Census 2001]

Any environmental impacts resulting from the Proposed Action at CCAFS would be expected to occur within Brevard County, Florida. Based upon the 2000 Census of Population and Housing, Brevard County had a population of 476,230 persons. [Source: Adapted from Census 2001] Of this total, 69,642 persons, or 14.7 percent, were minority, and 60,957 persons, or 12.8 percent, were in this low-income category. (See Section 3.1.1 for a discussion of the population distribution of the region of interest.)

3.1.5 Public Facilities and Emergency Services

The city of Cocoa provides potable water, drawn from the Floridan Aquifer, to the central portion of Brevard County. The maximum capacity is 167 million liters (l) (44 million gallons

[gal]) per day, and average daily consumption is about 99 million liters (l) (26 million gal) per day.

The cities of Cocoa, Cape Canaveral, Cocoa Beach, and Rockledge are each served by their own municipal sewer systems. Unincorporated areas are accommodated by several treatment plants, some of which have reached capacity.

Florida Power and Light supplies electricity to Brevard County. Police departments in the five municipalities of the central Brevard area have an average of one officer per 424 people, and fire protection has one full-time officer per 461 people. Health care within the area is available at 28 general hospitals, three psychiatric hospitals, and two specialized hospitals.

There were 222,072 housing units in Brevard County as of 2000. The average household in Brevard County in 2000 included 2.35 persons. There are no permanent residents at CCAFS. The nearest significant residential areas to CCAFS are Cape Canaveral, Cocoa Beach, and Merritt Island.

Public schools in Brevard County are part of a county-wide, single district school system with seventy-three schools and over 60,421 students in the 1993-1994 academic year. The school system has been growing since 1982, and capacity has been exceeded in some parts of central Brevard County. Growth in the district is expected to average four percent through 1996, the last year of school board projections. [USAF 1996]

Transportation in the region is served by highway, rail, airport, and harbor facilities. Federal, state and local roads provide highway service for Brevard County. Principles routes are Interstate 95, US Highway 1, and State Routes A1A, 407, 520, and 528. Bridges and causeways link the urban areas on the beaches to Merritt Island and the mainland. The Florida East Coast Railway affords rail service to the county, with a main line through the cities of Titusville, Cocoa, and Melbourne. Spur rail lines serve other parts of the county, including CCAFS. Several commercial and general aviation airports are located in the vicinity of CCAFS, the closest being Melbourne Regional Airport, approximately 30 miles south of the base. Port Canaveral, located at the southern boundary of CCAFS, is the area seaport. Industrial and commercial facilities are located at the port, and cruise ship use is increasing.

The CCAFS road system, which is linked to the regional highway system by the NASA Causeway to the west, State Route 402 to the north, the CCAFS south gate and State Highway A1A to the south, serves launch complexes, support facilities, and industrial areas. An airstrip near the center of the base is used by government aircraft and for delivery of launch vehicles and spacecraft. CCAFS is closed to the public. [USAF 2000]

3.1.5.1 Emergency Planning and Community Right-To-Know Act

NASA will comply with Toxic Release Inventory requirements, Emergency Planning and Community Right-To-Know responsibilities, and State and Local Right-to-Know and Pollution

Prevention requirements. NASA will support the Local Emergency Planning Committee as requested and will make available all Pollution Prevention and Community Right-To-Know information to the public upon request. [NASA 1995-B]

3.1.6 CCAFS Facilities and Services

CCAFS receives its water supply from the city of Cocoa, and uses an average of 2.85 million liters (0.75 million gal) per day. To support launch facility deluge systems, the distribution system at CCAFS was constructed to provide up to 114,000 liter (30,000 gal) per minute for up to ten minutes. [USAF 1998]

CCAFS provides for its own sewage disposal with on-site package sewage treatment plants (STPs). The LC-17 STP has a capacity of 57,000 liter (15,000 gal) per day and is permitted by the Florida Department of Environmental Protection (FDEP). [USAF 1998] CCAFS carries out its own sewage disposal with a consolidated wastewater treatment plant on site. [USAF 1994]

All nonhazardous solid waste that meets the requirements goes to the Brevard County Landfill. Other non-hazardous solid wastes are usually disposed through the Defense Reutilization and Marketing Office (DRMO). Hazardous wastes are accumulated at a number of locations throughout CCAFS pending disposal. Wastes are accumulated at either 90-day or satellite storage sites before transfer to one of two CCAFS hazardous waste storage facility, where they are stored for eventual shipment to a licensed hazardous waste treatment/disposal facility. [NASA 1997-A, USAF 1998] CCAFS has a Resource Conservation and Recovery Act (RCRA) permitted Explosive Ordnance Disposal (EOD) facility that supports disposal of CCAFS- & KSC-generated wastes, such as shavings from SRMs. All hazardous wastes generated at CCAFS are managed according to the 45th Space Wing (45SW) Petroleum Products and Hazardous Waste Management Plan (OPlan 19-14).

To prevent oil or petroleum discharges into U.S. waters, a Spills Prevention, Control, and Countermeasures Plan (SPCCP) is required by the EPA's oil pollution prevention regulation. A SPCCP has been integrated into the 45SW Hazardous Materials Response Plan (OPlan 32-3). Spills of oil or petroleum products that are federally listed hazardous materials will be collected and removed for proper disposal by a certified contractor according to this plan. All spills/releases will be reported to the host installation per OPlan 32-3.

The Launch Base Support (LBS) Contractor conducts all security services on CCAFS. A mutual agreement for fire protection services exists between the city of Cape Canaveral, KSC, and the LBS Contractor at CCAFS. The station is equipped with a dispensary under contract to NASA. The dispensary normally works on a forty-hour week basis. If medical services cannot be provided by the dispensary, hospitals at PAFB and in Cocoa, Titusville, and Melbourne are used. [USAF 1998] Disaster control is performed in accordance with 45SW OPlan 32-1, Disaster Preparedness Operations Plan. [USAF 1998]

3.1.7 Cultural Resources

Cultural resources include prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reasons. For ease of discussion, cultural resources have been divided into archaeological resources (prehistoric and historic), historic buildings and structures, and native populations/traditional resources (e.g., Native American sacred or ceremonial sites). There is no scientific or physical evidence for paleontological resources at CCAFS. [USAF 1996]

Numerous laws and regulations require that possible effects to cultural resources be considered during the planning and execution of federal undertakings. These laws and regulations stipulate a process of compliance, define the responsibilities of the federal agency proposing the action, and prescribe the relationship among other involved agencies (e.g., the State Historic Preservation Officer [SHPO] and the Advisory Council on Historic Preservation). In addition to the NEPA, the primary laws that pertain to the treatment of cultural resources during environmental analysis are the National Historic Preservation Act (NHPA) (especially Sections 106 and 110) the Archaeological Resources Protection Act (ARPA), the American Indian Religious Freedom Act (AIRFA), and the Native American Graves Protection and Repatriation Act (NAGPRA).

Only those cultural resources determined to be potentially significant under the above-cited legislation are subject to protection from adverse impacts resulting from an undertaking. To be considered significant, a cultural resource must meet one or more of the criteria established by the National Park Service that would make that resource eligible for inclusion in the National Register of Historic Places (National Register). The term "eligible for inclusion in the National Register" includes all properties that meet the National Register listing criteria, which are specified in the Department of the Interior regulations Title 36 CFR 60.4 and National Register Bulletin 15. [USAF 1998] Within the region, there are 81 sites that are listed in the National Register of Historic Places (NRHP) [DOI 2001], and 2 in the National Register of Historic Landmarks.

In 1982, an archeological/historical survey of CCAFS was conducted that consisted of literature and background searches and field surveys. The survey located 32 prehistoric and historic sites and several uninvestigated historic localities. Results of the field survey indicated that many of the archeological resources had been severely damaged by the construction of roads, launch complexes, power lines, drainage ditches, and other excavation. The survey recommended 21 launch complexes for further evaluation to determine eligibility for the NRHP. [USAF 2000] CCAFS is a National Historic Landmark (NHL) District, and LC-17 has been identified as potentially eligible for listing in the NRHP.

The protection and interpretation of significant resources associated with the space program are underway by the Department of the Interior, National Park Service, and USAF. Areas at CCAFS designated as landmark sites include the Mission Control Center and launch complexes 5, 6, 13, 14, 19, 26, and 34, which were used during the Mercury, Gemini, and early Apollo manned space flights. [USAF 2000]

3.2 NATURAL ENVIRONMENT

3.2.1 Meteorology and Air Quality

3.2.1.1 Meteorology

The climate of the region is subtropical with two distinct seasons: long, warm, humid summers and short, mild, and dry winters. [USAF 2000] Rainfall amounts vary both seasonally and yearly. Average rainfall is 128 cm (51 in), with about 70 percent falling during the wet season (May to October). Temperature is less variable — prolonged cold spells and heat waves rarely occur, owing to CCAFS's location adjacent to the Atlantic Ocean and the Indian and Banana Rivers. The average annual temperature at CCAFS is 22 ºC (71 ºF). Average monthly temperatures range from 16 ºC (60 ºF) during January to 27 ºC (81 ºF) during July. Tropical storms, tropical depressions, and hurricanes occasionally strike the region, generally in the period starting in August and ending in mid-November. The probability of winds reaching hurricane force in Brevard County in any given year is approximately one in twenty. [USAF 1996] Tornadoes may occur, but are very scarce. Hail falls occasionally during thunderstorms, but hailstones are usually small and seldom cause much damage. Snow and freezing in the region are rare. Temperature inversions are infrequent, occurring approximately two percent of the time. [USAF 1996]

Summer weather typically lasts about nine months of the year, starting in April. The Cape Canaveral area has the highest number of thunderstorms in the United States, and one of the highest frequencies of occurrence in the world during the summer. On average, thunderstorms occur 76 days per year at Cape Canaveral, commonly in the afternoon and usually result in lower temperatures and an ocean breeze. Occasional cool days occur as early as November, but winter weather generally commences in January and extends through March. [NASA 1997-A] Rainfall distribution is seasonal, with a wet season occurring from May to October, while the remainder of the year is relatively dry. Average annual rainfall for CCAFS is 48.5 inches, seventy percent of which occurs from May through October at the rate of approximately five inches per month. [USAF 1996]

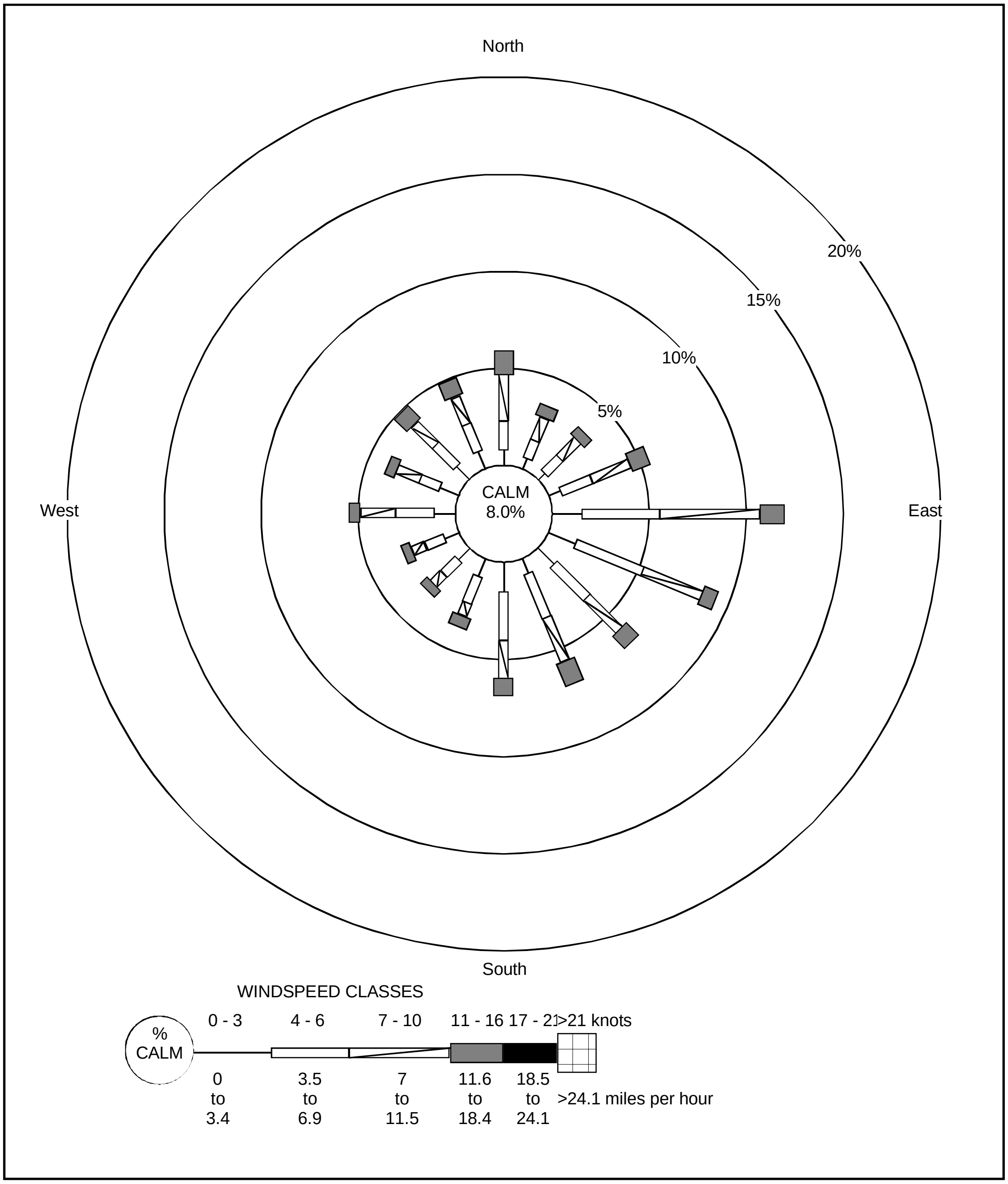
The wind rose in Figure 3-5 shows the annual average frequency distribution of average wind speed and direction in the vicinity of CCAFS. At CCAFS, winds typically come from the north/northwest from December through February, from the southeast from March through May, and from the south from June through August. Sea breeze and land breeze phenomena occur commonly over any given 24-hour period due to unequal heating of the air over the land and ocean. Land breeze (toward the sea) occurs at night when air over land has cooled to a lower temperature than that over the sea; sea breeze (toward the land) occurs during the day when air temperatures over the water are lower. The sea breeze and land breeze phenomena occur frequently during the summer months, less frequently during the winter. [NASA 1997-A]

3.2.1.2 Air Quality

Air quality at CCAFS is considered good, primarily due to a predominant easterly sea breeze, (Figure 3-4). CCAFS is located in the federally defined Central Florida Intrastate Air Quality Control Region (AQCR 48), which is classified by the EPA as an attainment area for all of the criteria pollutants. There are no Class I or nonattainment areas for criteria pollutants (ozone [O_3], nitrogen oxides [NO_x], sulfur dioxide [SO_2], lead [Pb], carbon monoxide [CO], and particulates) within about 96 km (60 mi) of CCAFS. Orange County was a nonattainment area for ozone until 1987, when it was redesignated as an ozone attainment maintenance area. [DC 1995]

The station and its vicinity are considered to be “in attainment” or “unclassifiable” with respect to National Ambient Air Quality Standards (NAAQS) for criteria pollutants. [USAF 1998] The criteria pollutants and the federal and state standards are listed in Table 3-1. NAAQ primary and secondary standards apply to continuously emitting sources, while a launch is considered to be a one-time, short-term moving source; however, the standards will be used for comparative purposes throughout this EA to provide a reference, since no other, more appropriate standards exist.

The daily air quality at CCAFS is chiefly influenced by a combination of vehicle traffic, maintenance activities, utilities fuel combustion, and incinerator operations. Space launches influence air quality only episodically. Two regional power plants are located within 20 km (12 mi) of the station and are believed to be the primary source of occasional elevations in nitrogen dioxide and sulfur dioxide levels. Ozone has been CCAFS’s most consistently elevated pollutant. [NASA 1997-A] However, since January 1992, the primary standard for ozone has not been exceeded. [DC 1995]



Source: [USAF 1998]

Figure 3-4. Wind Rose Indicating Wind Speed and Direction — Lower Atmospheric Conditions: Cape Canaveral 1968 - 1978 Annual Averages

Table 3-1 State and Federal Air Quality Standards

Pollutant	Averaging Time	State of Florida Standard	Federal Primary Standard	Federal Secondary Standard
Carbon Monoxide (CO)	8-hour *	10 mg/m^3 (9 ppm)	10 mg/m^3 (9 ppm)	none
	1-hour *	40 mg/m^3 (35 ppm)	40 mg/m^3 (35 ppm)	none
Lead (Pb)	Quarterly Arithmetic Mean	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	same as primary
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	100 $\mu g/m^3$ (0.05 ppm)	100 $\mu g/m^3$ (0.05 ppm)	same as primary
Ozone (O_3)	1-hour +	235 $\mu g/m^3$ (0.12 ppm)	235 $\mu g/m^3$ (0.12 ppm)	same as primary
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	60 $\mu g/m^3$ (0.02 ppm)	80 $\mu g/m^3$ (0.03 ppm)	none
	24-hour *	260 $\mu g/m^3$ (0.1 ppm)	365 $\mu g/m^3$ (0.14 ppm)	none
	3-hour *	1300 $\mu g/m^3$ (0.5 ppm)	none	1300 $\mu g/m^3$ (0.5 ppm)
Particulate Matter 10 (PM-10)**	Annual Arithmetic Mean	50 $\mu g/m^3$	50 $\mu g/m^3$	same as primary
	24-hour *	150 $\mu g/m^3$	150 $\mu g/m^3$	same as primary
Particulate Matter 2.5 (PM-2.5)***	Annual Arithmetic Mean		15 $\mu g/m^3$	same as primary
	24-hour *		65 $\mu g/m^3$	same as primary

Source: [EPA 2000]

NOTE: mg/m^3 = milligrams per cubic meter

$\mu g/m^3$ = micrograms per cubic meter

ppm = parts per million

* Not to be exceeded more than once per year

** Recent litigation has successfully challenged the PM-10 NAAQS standard. The EPA has filed an appeal.

*** The EPA promulgated a new standard for particulate matter with a diameter less than 2.5 microns (PM-2.5) on 18 July 1997. However, on 14 May 1999, the US Court of Appeals for the District of Columbia ruled that the EPA presented insufficient justification for the standard. The actual content of the reproposed standard, timing of the proposal, the promulgation date, and the date by which the EPA could determine those areas in compliance and those not in compliance with the standard are highly uncertain. In the 1997 proposal, the EPA expected to determine compliant and non-compliant areas of the country between 2002 and 2004. Under this timeline, controls of PM-2.5 would not be required before 2002, and they would be required after that time only in those areas determined to exceed the standard.

+ The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is less than or equal to one.

3.2.2 Noise

The primary noise generators at CCAFS prelaunch processing sites are support equipment, vehicles, and air conditioners. Occasionally, increased noise levels are experienced on a short-term basis when launches occur at one of the launch complexes. Ambient conditions in the prelaunch processing areas are typical of those for an urban commercial business or light industrial area. On the whole, day-to-day operations at CCAFS most likely approximate that of any urban industrial area, reaching levels of 60 to 80 decibels (dBA), but with a 24-hour average ambient noise level that is somewhat lower than the EPA-recommended upper level of 70 dBA. [USAF 1996, NASA 1997-A]

Occasionally, increased noise levels are experienced on a short-term basis when launches occur at one of the launch complexes. Noise is generated from the following sources: combustion noise emanating from the rocket chamber; jet noise generated by the interaction of the exhaust jet with the atmosphere; combustion noise resulting from the postburning of the fuel-rich combustion products in the atmosphere; and sonic booms. The major noise source in the immediate vicinity of the launch pad is the combination of these noises. The nature of the noise may be described as intense, of relatively short duration, composed predominantly of low frequencies, and occurring infrequently. This noise is usually perceived by the surrounding communities as a distant rumble. A concrete exhaust flume on each pad deflects exhaust gases away from the pad to reduce the noise and shock wave that result from ignition of solid rockets and the first stage of the launch vehicle. [USAF 1996]

Table 3-2. Launch Noise Levels at Kennedy Space Center

SOURCE	DISTANCE FROM LAUNCH PAD	NOISE LEVEL (dBA)	REMARKS
Titan IIIC	9,388 m (5.82 mi)	93.7	21 October 1965
Saturn I	9,034 m (5.60 mi)	89.2	Average of 3 launches
Saturn V	9,384 m (5.82 mi)	91.0	15 April 1969
Atlas	4,816 m (2.99 mi)	96.0	Comstar
Space Shuttle	9,384 m (5.82 mi)	89.6	Estimated
Delta II*	6,452 m (4.00 mi)	98.0	Extrapolated from Measured Values

Source: [NASA 1997-A, *USAF 1994]

*Launch Noise Level at CCAFS [USAF 1994]

Space launches also generate sonic booms during vehicle ascent and stage reentry. Launch-generated sonic booms are directed upward and in front of the vehicle and occur over the Atlantic Ocean. Stage reentry sonic booms also occur over the open ocean and do not impact developed coastal areas. [USAF 1996] Some launch vehicle related noise levels measured at KSC are shown in Table 3-2.

By comparison, peak noise levels created by industrial and construction activities — mechanical equipment, such as diesel locomotives, cranes, and rail cars — could range from about 90 to 111 dBA. Vehicular traffic noise ranges from around 85 dBA for a passenger auto to about 100 dBA for a motorcycle. [NASA 1997-A]

3.2.3 Land Resources

3.2.3.1 Geology

CCAFS lies on a barrier island composed of relict beach ridges formed by wind and wave action. The island is 7.3 km (4.5 mi) wide at its widest point. Its land surface ranges from sea level to 6 m (20 ft) above mean sea level (MSL) at the harbor dredge disposal site near Port Canaveral. The average land surface elevation is approximately 3 m (10 ft) above MSL. The higher naturally occurring elevations occur along the eastern portion of CCAFS, with a gentle slope to lower elevations toward the marshlands along the Banana River. The geology underlying CCAFS can be generally defined by four stratigraphic units: the surficial sands, the Caloosahatchee Marl, the Hawthorn Formation, and the limestone formations of the Floridan aquifer. The surficial sands immediately underlying the surface are marine deposits that typically extend to depths of approximately 3 to 9 m (10 to 30 ft) below the surface. The Caloosahatchee Marl underlies the surficial sands and consists of sandy shell marl that extends to a depth of 21 m (70 ft) below the surface. The Hawthorn Formation, which consists of sandy limestone and clays, underlies the Caloosahatchee Marl and is the regional confining unit for the Floridan aquifer. This formation is generally 24 to 36 m (80 to 120 ft) thick, typically extending to a depth of approximately 36 m (180 ft) below the surface. Beneath the Hawthorn Formation lie the limestone formations of the Floridan aquifer, which extend several thousand feet below the surface at CCAFS.

The principal geologic hazard in central Florida is sinkholes that develop when overlying soils collapse into existing cavities. CCAFS is not located in an active sinkhole area, and the review of topographic maps did not reveal the presence of any sinkholes. The Canaveral Peninsula is not prone to sinkholes, since the limestone formations are over 30 m (100 ft) below the ground surface, and confining units minimize recharge to the limestone. A seismological investigation conducted by the U.S. Department of Commerce shows that the underground structure in the heavy launch area is free of anomalies, voids, and faults. CCAFS is located in Seismic Hazard Zone 0 as defined by the Uniform Building Code. Seismic Zone 0 represents a very low potential risk for large seismic events. [USAF 1998]

3.2.3.2 Soils

Soils on CCAFS have been mapped by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS). Soil types that have been identified by the NRCS in the vicinity of LC-17 are Canaveral Complex, Palm Beach Sand, Urban Land, and Canaveral-Urban Land Complex. These native soils are composed of highly permeable, fine-grained sediments typical of beach and dune deposits. Based on examination of well and soil borings from CCAFS, the near-surface stratigraphy is fairly uniform, consisting of Pleistocene age sand deposits that underlie the installation to depths of approximately 30 m (100 ft). [NASA 1997-A]

3.2.4 Hydrology and Water Quality

3.2.4.1 Surface Waters

The station is located on a barrier island that separates the Banana River from the Atlantic Ocean. As is typical of barrier islands, the drainage divide is the dune line just inland from the ocean. Little runoff is naturally conveyed toward the ocean; most runoff percolates or flows westward toward the Banana River. The majority of storm drainage from CCAFS is collected in manmade ditches and canals and is directed toward the Banana River. The North Banana River is a sanctuary for the endangered manatee.

Major inland water bodies in the CCAFS area are the Indian River, Banana River, and Mosquito Lagoon. These water bodies tend to be shallow except for those areas maintained as part of the Intracoastal Waterway. The Indian and Banana Rivers connect adjacent to Port Canaveral by the Barge Canal, which bisects Merritt Island; they have a combined area of 600 sq km (232 sq mi) in Brevard County and an average depth of 1.8 m (6 ft). This area receives drainage from 2,160 sq km (834 sq mi) of surrounding terrain.

Predominant ocean currents in the vicinity of CCAFS are north of the area. From the Cape Canaveral region to 26 km (16 mi) offshore, the average ocean current speed is 1.7 to 5 km per hour (kph) (1 to 3 miles per hour [mph]). Beyond about 26 km (16 mi), the system of currents becomes known as the Florida Current of the Gulf Stream. The central axis of the Gulf Stream is located approximately 83 km (50 mi) off the coast of Florida at Cape Canaveral.

3.2.4.2 Surface Water Quality

Surface water quality near CCAFS and KSC is monitored at 11 long-term monitoring stations that are maintained by NASA. It is also monitored by the Air Force Bioenvironmental Engineering Services on a quarterly basis at seven sites. Other monitoring stations in the general area are maintained by Brevard County, the U.S. Fish and Wildlife Service, and the FDEP. [NASA 1997-A] The FDEP has classified water quality in the Florida Middle East Coast Basin as “poor to good” based on the physical and chemical characteristics of the water, as well as whether they meet their designated use under FAC 62-3. The upper reaches of the Banana River adjacent to Cape Canaveral AS and the lower reaches of Mosquito Lagoon have generally good water quality due to lack of urban and industrial development in the area. However, recent studies by NASA indicate that certain parameters (i.e., primarily phenols and silver) consistently exceed state water quality criteria, with hydrogen ion concentration (pH), iron, and aluminum occasionally exceeding criteria. Nutrients and metals, when detected, have generally been below Class II standards. Areas of poor water quality exist along the western portions of the Indian River, near the city of Titusville, and in Newfound Harbor in southern Merritt Island. [USAF 1998] Water quality monitoring data for the southern segment of the Banana River is summarized in Table 3-3.

The Banana River is designated a Class III surface water, as described by the Federal Clean Water Act of 1977. Class III standards are intended to maintain a level of water quality suitable for recreation and the production of fish and wildlife communities. The Banana River is also designated an Outstanding Florida Water (OFW) by the FDEP. An OFW is provided the highest degree of protection of any Florida surface waters. [NASA 1997-A]

Table 3-3 Summary of Water Quality Monitoring Data for South Banana River

Parameter	Average Value	Range of Values	State FDEP Class III Standards
Conductivity (µmhos/cm)	33,300	12,470 - 50,500	Varies
Total Suspended Solids (mg/l)	32	1 - 143	No standard
Turbidity NTU	2.09	0.76 - 5.0	29 NTU above background
Oil and Grease (mg/l)	0.8	<0.2 - 3.9	≤5.0; no taste or odor
Phenols (µg/l)	128	32 - 364	< 300
Alkalinity (mg/l)	130	109 - 168	≥20 (fresh water)
pH	8.6	7.4 - 9.2	6.5 - 8.5 (marine water)
Total Kjedahl Nitrogen (mg/l)	1.96	0.23 - 15.00	No standard
Nitrate Nitrogen (mg/l)	0.02	<0.02 - 0.06	No standard
Ortho Phosphate (mg/l)	0.032	<0.025 - 0.08	No standard (marine)
Chlorophyll A (mg/m^3)	5.0	<0.5 - 74.7	No standard
Biological Oxygen Demand (mg/l)	2.5	<1 - 7	No standard
Chemical Oxygen Demand (mg/l)	712	478 - 1361	No standard
Dissolved Oxygen (mg/l)	6.6	2.1 - 10.2	≥ 4 mg/l (marine water)
Total Organic Carbons (mg/l)	5.41	2.23 - 13.00	No standard
Aluminum (mg/l)	0.62	< 0.10 - 8.47	≤ 1.5 (marine water)
Cadmium (µg/l)	0.56	<0.01 - 2.86	≤ 0.3
Chromium (mg/l)	0.020	<0.001 - 0.05	0.5 Cr^{+6})
Iron (mg/l)	0.075	<0.040 - 0.178	0.3 (marine water)
Zinc (mg/l)	0.023	< 0.01 - 0.234	86 (fresh water)
Silver (µg/l)	17.88	< 0.05 - 31.3	≤ 0.05 (marine water)

Source: [NASA 1997-A]

NOTE: mg/l = milligram per liter
µg/l = microgram per liter
µmhos/cm = micromhos per centimeter
NTU = Nephelometric Turbidity Units

3.2.4.3 Ground Waters

Ground water at the station occurs under both confined (artesian) and unconfined (nonartesian) conditions. Confined ground water is located in the Floridan Aquifer, which serves as the primary ground water source in the coastal lowlands. Recharge to the Floridan Aquifer occurs primarily in northern and central Florida. [USAF 1994]

Although good quality water may be obtained from the Floridan Aquifer throughout much of the state, water from this formation on CCAFS is highly mineralized and is not used for domestic or commercial purposes. Water for domestic and commercial purposes in this area is generally retrieved from the city of Cocoa. The water is pumped from wells in east Orange County that extract water from the Floridan Aquifer.

This unconfined surficial aquifer is composed of recent and Pleistocene age surface deposits, and is usually found up to 1.5 m (5 ft) or so below land surface. It is recharged by rainfall along the coastal ridges and dunes. The unconfined aquifer formation at CCAFS ranges in depth from about 15 m (50 ft) at the coastal ridge to less than 6 m (20 ft) in the vicinity of the St. Johns River. The unconfined aquifer beneath LC-17 is not typically used as a water source, except for residential irrigation.

3.2.4.4 Ground Water Quality

Two aquifer systems underlie CCAFS: the surface aquifer and the Floridan aquifer. The surface aquifer system, which is composed generally of sand and marl. The water table in the surface aquifer is generally located a few feet below the ground surface and is principally recharged by precipitation. Ground water of the Floridan Aquifer at CCAFS is not used as a domestic or commercial water source. Table 3-4 summarizes the water quality characteristics of a sample collected from the Floridan Aquifer underlying the west-central portion of the station. The sample exceeded national drinking water standards for sodium, chloride, and total dissolved solids (TDS). [NASA 1997-A]

Table 3-4 Ground Water Quality for the Floridan Aquifer at CCAFS

Parameter	Average Value (mg/l)	Drinking Water Standards (mg/l)
Nitrates (as Nitrogen)	< 0.01	10 (primary standard)
Chlorides	540	250 (secondary standard)
Copper	<0.01	1.0 (secondary standard)
Iron	0.02	0.3 (secondary standard)
Manganese	<0.001	0.05 (secondary standard)
Sodium	1400	160 (primary standard)
Sulfate	85	250 (secondary standard)
Total Dissolved Solids	1,425	250 (secondary standard)
pH	7.6	6.5 - 8.5(secondary standard)
Zinc	<0.01	5.0 (secondary standard)
Arsenic	<0.01	0.05 (primary standard)
Barium	0.02	1.0 (primary standard)
Cadmium	<0.001	0.01 (primary standard)
Chromium	0.001	0.05 (primary standard)
Lead	<0.001	0.05 (primary standard)
Mercury	0.0005	0.002 (primary standard)
Selenium	0.006	0.01 (primary standard)

Source: [NASA 1997-A]

NOTE: mg/l = milligrams per liter

primary standard = National Interim Primary Drinking Water Regulations

secondary standard = National Secondary Drinking Water Regulations

Overall, water in the unconfined aquifer in the vicinity of KSC and CCAFS is of good quality and meets the State of Florida Class G-II (suitable for potable water use; total dissolved solids less than 10,000 milligrams per liter [mg/l]) and national drinking water quality standards for all parameters, with the exception of iron, and/or total dissolved solids. [NASA 1997-A] There are no potable water wells located at LC-17 or in its vicinity.

Ground water quality in five monitoring wells at LC-17 is generally good, with some detectable quantities of trace metals and organic compounds reported in one well, and detectable zinc concentrations in another.

3.2.5 Biotic Resources

The station is located in east-central Florida on the Cape Canaveral peninsula. Ecological resources at CCAFS are influenced by the Atlantic Ocean on the east and the Banana River on the west. Relic dunes on CCAFS have created inner-dunal swales that have been classified by the U.S. Fish and Wildlife Service as freshwater wetlands. There is also a naturally occurring pond and wetlands in the vicinity of LC-17. Vegetation communities and related wildlife habitats are representative of barrier island resources of the region. Major community types at CCAFS include beach, coastal strand and dunes, coastal scrub, lagoons, brackish marsh, and freshwater systems in the form of canals and borrow pits.

The restrictive nature of CCAFS and KSC activities has allowed large areas of land to remain relatively undisturbed. In addition to communities found at CCAFS, coastal hammocks and pine flatwoods are found on KSC to the northwest and increase the ecological diversity and richness of the area. A majority of the 65 sq km (25 sq mi) complex consists of coastal scrub, woodland, strand, and dune vegetation. Coastal scrub and coastal woodland provide excellent cover for resident wildlife. Coastal strand occurs immediately inland of the coastal dunes and is composed of dense, woody shrubs. Coastal dune vegetation (a single layer of grass, herbs, and dwarf shrubs) exists from the high tide point to between the primary and secondary dune crest. Wetlands represent only a minor percentage (less than 4 percent) of the total land area and include freshwater marsh, mangrove swamp, and salt swamp. Known hammocks are small, total less than 0.8 sq km (0.3 sq mi), and are characterized by closed canopies of tree, shrub, and herb vegetation. Most of the wildlife species resident at the station can be found in each of these vegetation communities. No federally designated threatened or endangered flora is known to exist at CCAFS. [USAF 1996]

3.2.5.1 Terrestrial Biota

Natural upland vegetation communities found on CCAFS are coastal dune, coastal strand, coastal scrub, and hammock. Wetlands found on-site include both marshes and swamps. [USAF 1994]

The coastal dune community extends from the coastal strand system to the high tide line, and within the salt-spray zone. Dune systems develop on poorly consolidated, excessively drained sands that are exposed to constant winds and salt spray. This zone is delineated by the interior limit of sea oats (*Uniola paniculata*) growth, which has been listed as a state species of special concern. Florida Statute 370.41 prohibits the disturbance or removal of sea oats.

LC-17 is surrounded by coastal scrub vegetation. As a result of a recent study by the Nature Conservancy, the overgrown oak scrub has now been classified as maritime hammock. The coastal scrub community covers approximately 37.6 sq km (14.5 sq mi), or about 78 percent of the undeveloped land on CCAFS. This community is distributed on excessively drained, nutrient-deficient marine sands.

Coastal strand vegetation occurs between the coastal dune and scrub communities and lies just east of LC-17. Coastal strand communities exist on sandy, excessively drained soils dominated by shrubs and often are nearly devoid of ground cover vegetation.

CCAFS beaches are nonvegetated, but provide significant wildlife resources. The tidal zone supports a large number of marine invertebrates, as well as small fish that are food for various shorebirds. CCAFS and KSC beaches are also important nesting areas for several varieties of sea turtles. Sea turtles and turtle hatchlings are affected by exterior lights. To minimize impacts to sea turtles, CCAFS has implemented a lighting policy for management of exterior lights at the installation. The policy requires the use of low-pressure sodium lights unless prohibited by safety or security purposes.

Coastal hammocks are characterized by closed canopies of cabbage palm. Hammocks are shaded from intense insolation, and therefore retain higher levels of soil moisture than the previously described habitats. No hammocks occur in the immediate vicinity of LC-17, the nearest one being about 3 km (1.8 mi) west of the site, adjacent to the Banana River.

Wetlands within CCAFS and surrounding station facilities are important wildlife resources; there are four isolated emergent wetlands and a major east-west drainage canal. Wetland types that are found in the area include fresh water ponds and canals, brackish impoundments, tidal lagoons, bays, rivers, vegetated marshes, and mangrove swamps. No marsh or swamp systems occur near LC-17. These soils are not suitable for cultivation, yet do contain swamp plants that support migratory and wading birds. The wetlands support a wide variety of aquatic plants and animals, including the American alligator, a threatened species. The four isolated wetlands are vegetated primarily by cattails with Carolina-plains willow, wax myrtle, and groundsel bush along the edge of the system. The systems are small and appear to have originated as borrow areas for adjacent construction sites. [USAF 1994]

Species of plant and animal life observed or likely to occur on CCAFS are listed in reference USAF 1994.

3.2.5.2 Aquatic Biota

The northern Indian River lagoon ecosystem is a shallow system with limited ocean access, limited tidal flux, and generally mesohaline salinities. The aquatic environment is subject to wide fluctuations in temperature and salinity due to the shallowness of the system. [USAF 1996]

Sea grasses are present in the Indian River system, generally found in patches in shoal areas less than 1 m (3 ft) deep and surrounded by open, sandy terrain. Benthic invertebrates found in the northern Indian and Banana Rivers include marine worms, mollusks, and crustaceans, typical of estuarine systems. Epibenthic invertebrates collected from the area included horseshoe crabs, blue crabs, and penaid shrimp.

The area is not considered an important nursery area for commercially important shrimp species. Mosquito Lagoon, north of the complex, has been considered an important shrimp nursery area. Blue crabs were determined to spawn in the area.

Few freshwater fish species inhabit the area. Many of the area's freshwater fish species are believed to have been introduced by man. Primary reasons for the low diversity in fish species are considered to be latitude, climate, low habitat diversity, and limited ocean access.

3.2.5.3 Launch Complex 17

A potential Region of Influence (ROI) has been identified for the proposed launches as a one-mile radius surrounding the launch complex, based on previous launch vehicle assessments at CCAFS. Threatened or endangered species potentially occurring within the ROI are listed in Table 3-5. Preliminary review of existing vegetation mapping in the vicinity of the launch complex identified the dominant vegetation as coastal scrub community and coastal woodland community. The distinction between the two systems as previously described is a difference in the height of the vegetation and the openness of the canopy. The western portion of the ROI consists primarily of coastal woodland whereas the eastern portion of the ROI up to Pier Road supports a more open coastal scrub community. This portion of the ROI also displays signs of being recently burned. Controlled burns are implemented throughout much of CCAFS using prescribed schedules in accordance with the control burning plan. These burns are important for improving and preserving wildlife habitat as well as for reducing the occurrence of uncontrolled fires and enhancing security visibility. The vegetation on the east side of Pier Road is characterized as coastal strand with dune vegetation along the beach interface.

The vegetative communities are partitioned into discrete units by the presence of line-of-site clear zones, roads, and widely dispersed industrial complexes. These clear zones provide an ecotone effect between the adjacent scrub/woodland community and a predominantly herbaceous grassy community. An ecotone is a transition area between the adjacent ecological communities usually containing species from both communities. Bahia grass was the dominant species bordering the road shoulder vegetation and the industrial buildings. The transition zone between the grassy community and the forested community includes wax myrtle, stoppers, groundsel, and Brazilian pepper. These species provide a nearly impenetrable shrub/scrub layer.

3.2.5.4 Threatened and Endangered Species

The U.S. Fish and Wildlife Service (FWS), the Florida Game and Fresh Water Fish Commission (FGFWFC), and the Florida Commission on Rare and Endangered Plants and Animals (FCREPA) protect a number of wildlife species listed as endangered or threatened under Federal or State of Florida law. The presence, or potential for occurrence, of such species on CCAFS was determined from consultations with FWS, FGFWFC, and CCAFS and KSC environmental staff, and from a literature survey. Table 3-5 lists those endangered or threatened species in Brevard County residing or seasonally occurring on CCAFS and adjoining waters.

A review of the list indicates that only six species (American alligator, eastern indigo snake, southeastern kestrel, Florida scrub jay, and two species of prickly pear cactus) potentially occur in the immediate vicinity of LC-17. Three additional species may occasionally occur in wetlands on CCAFS. West Indian manatees, green turtles, and loggerhead turtles are known to occur in the Banana River, Mosquito Lagoon, and along Atlantic Ocean beaches. The red-cockaded woodpecker is not known to occur in the vicinity of LC-17.

Table 3-5. Threatened, Endangered, and Candidate Species Occurring or Potentially Occurring at Cape Canaveral AFS, Florida

Common Name	Scientific Name	Federal Status	State Status
PLANTS			
Giant leatherfern	Acrostichum danaeifolium	-	T
Curtiss' milkweed	Asclepias curtissii	-	E
Satin-leaf	Chrysophyllum olivaeforme	-	E
Coastal vervain	Glandulareia maritima	-	E
Nodding pinweed	Lechea cernua	-	T
Hand fern	Ophioglossum palmatum	-	E
Golden polypody	Phlebodium aurea	-	T
Beach-star	Remirea maritima	-	E
Nakedwood	Myciantes fragrans	-	T
Sand dune spurge	Chamaesyce cumulicola	-	E
Inkberry	Scaevola plumieri	-	T
Sea lavender	Tournefortia gnaphalodes	-	E
REPTILES AND AMPHIBIANS			
Gopher frog	Rana capito	-	SSC
American alligator	Alligator mississippiensis	T(S/A)	T(S/A)
Eastern Indigo snake	Drymarchon corais couperi	T	T
Green sea turtle	Chelonia mydas	E	E
Loggerhead sea turtle	Caretta caretta	T	T
Leatherback sea turtle	Dermochelys coriacea	E	E
Atlantic (Kemp's) Ridley sea turtle	Lepidochelys kempi	E	E
Hawksbill sea turtle	Eretmochelys imbricata imbricata	E	E
Florida scrub lizard	Sceloporus woodi	C2	-
Florida pine snake	Pituophis melanoleucus mugitus	-	SSC
Gopher tortoise	Gopherus polyphemus	-	T
Atlantic salt marsh snake	Nerodia clarkii taenaita	T	T
BIRDS			
Wood stork	Mycteria americana	E	E
Bald eagle	Haliaeetus leucocephalus	T	T
Peregrine falcon	Falco peregrinus	E(S/A)	E
Florida scrub jay	Aphelocoma coerulescens	T	T
Piping plover	Charadrius melodus	T	T
Least tern	Sterna antillarum	-	T
Southeastern American kestrel	Falco sparverius paulus	-	T
Burrowing Owl	Athene cunicularia	-	SSC
Roseate spoonbill	Ajaia ajaja	-	SSC
Southeastern snowy plover	Charadrius alexandriainus tenuirostris	C2	T
Osprey	Pandion haliaetus	-	SSC
American Oystercatcher	Haematopus palliatus	-	SSC
Brown Pelican	Pelecanus occidentalis	-	SSC
Snowy egret	Egretta thula	-	SSC
Little blue heron	Egretta caerulea	-	SSC
Tricolored heron	Egretta tricolor	-	SSC
Reddish egret	Egretta rufescens	-	SSC
White Ibis	Eudocimus albus	-	SSC
Black skimmer	Rynchops niger	-	SSC
Roseate tern	Sterna dougallii dougallii	T	T
MAMMALS			
West Indian manatee	Trichechus manatus latirostris	E	E
Southeastern beach mouse	Peromyscus polionotus niveiventris	T	T
Finback whale	Balaenoptera physalus	E	E
Humpback whale	Megaptera novaeangliae	E	E
Northern right whale	Eubalaena glacialis	E	E
Sei whale	Baeaenoptera borealis	E	E
Sperm whale	Physeter catodon	E	E
Florida mouse	Podomys floridanus	-	SSC

Source: [45SW 2000]

C = candidate (former Category C1); C2 = former Category 2; E = endangered; SSC = State special concern species; (S/A) = listed by similarity of appearance to a listed species; T = threatened

SECTION 4

ENVIRONMENTAL IMPACTS OF PROPOSED ACTION AND ALTERNATIVES

Pre-launch activities (i.e., those activities occurring at the launch site) would involve integration and testing with the launch vehicle and final launch preparations, such as launch vehicle fueling operations, culminating in a successful normal launch of the SIRTF Observatory.

The following sections summarize the environmental effects of normal Delta II 7920H pre-launch activities, launch and flight, and the effects of possible abnormal operations or flight conditions for the launch of the SIRTF Observatory.

4.1 ENVIRONMENTAL IMPACTS OF A NORMAL DELTA II 7920H LAUNCH AT CCAFS

4.1.1 Air Quality

4.1.1.1 Emissions

For a normal Delta II launch, airborne emissions are typically generated by prelaunch, launch, and post-launch operations. Emissions resulting from Delta II operations include fuel and oxidant vapors which may escape to the atmosphere during prelaunch or post-launch operations. All CCAFS facilities involved in normal prelaunch activities have been either permitted or exempted by the Florida Department of Environmental Protection (FDEP), and will not be discussed in this document. Please refer to reference USAF 1994 for further information. The first stage of the Delta II uses RP-1 as a fuel and liquid oxygen as an oxidizer. The vehicle's second stage employs Aerozine 50 as a fuel and nitrogen tetroxide (N_2O_4) as an oxidizer. Both stages are loaded while the vehicle is on the launch pad.

Typically, RP-1 and liquid oxygen are loaded into the first stage of the launch vehicle twice during the normal sequence of prelaunch operations. Minor amounts of fuel and oxidizer are loaded approximately two weeks prior to launch to test the fuel system's integrity. Following testing, the tanks are cleaned, and loaded to full capacity several hours before launch. Any fuel spillage that occurs during the loading process are collected in sealed trenches leading from the RP-1 storage tanks to the launch pad. The RP-1 is then evacuated from these trenches into sealed 55 gallon drums for subsequent disposal by a certified subcontractor. Vapor losses during first stage loading are minimal, due to the low volatility of RP–1.

Aerozine 50 and N_2O_4 would be loaded into the second stage 3 days prior to the scheduled launch date. Pollution control devices are utilized to control emissions resulting from fuel and oxidizer handling operations. Chemical scrubbers are used to remove pollutants from the vapors; the scrubber solutions are then released into drums for disposal by a certified subcontractor. Spillage of Aerozine 50 or N_2O_4, although not expected, would be handled in accordance with 45th Space Wing (45SW) OPlan 32-3.

Nitrogen oxides (NO_x) may enter the atmosphere through propellant system venting, a procedure used to maintain proper operating pressures. Air emission control devices will be used to mitigate this small and infrequent pollutant source. First stage propellants will be carefully loaded using a system with redundant spill-prevention safeguards. Aerozine 50 vapors from second stage fuel loading will be processed to a level below analytical detection by a citric acid scrubber. Likewise, N_2O_4 vapors from second stage oxidizer loading will be passed through a sodium hydroxide (NaOH) scrubber. These scrubber wastes will be disposed of by a certified hazardous waste contractor according to the 45SW Petroleum Products and Hazardous Waste Management Plan. [OPlan 19-14] The scrubber operation is a FDEP permitted activity. Air emissions monitoring is conducted in accordance with the FDEP permit.

Emergency release could occur during the rupture of a part of the propellant loading system, mainly as a result of over pressurization of the system. Redundant flow meters and automatic shutdown devices on the propellant loading system would prevent overfilling of the propellant tanks. Automatic pressure monitoring devices on the tanks and feed system are designed to prevent over pressurization.

The majority of launch emissions are produced by the nine graphite epoxy motor (GEMs) solid rockets on the Delta II 7920H vehicle and the liquid first stage of the Delta II vehicle during launch. Six of the GEMs and the first stage will be ignited during liftoff. The primary products of GEM combustion are carbon monoxide (CO), carbon dioxide (CO_2), hydrochloric acid (HCl), aluminum oxide (Al_2O_3) in soluble and insoluble forms, nitrogen oxides

Table 4-1 Combustion Products for the LDXL GEM Solid Rocket Motors

Combustion Product	Product Mass Fraction	Product Mass per GEM 16,738 kg (36,900 lb)		Total Product Mass for 9 LDXL GEMs 150,640 kg (332,100 lb)	
		kg	lb	kg	lb
AlCl	0.0003	5.0	11.1	45.2	99.6
AlClO	0.0001	1.7	3.7	15.1	33.2
$AlCl_2$	0.0002	3.3	7.4	30.1	66.4
$AlCl_3$	0.0001	1.7	3.7	15.1	33.2
Al_2O_3	0.3774	6316.8	13926.1	56851.4	125334.5
CO	0.2237	3744.2	8254.5	33698.1	74290.8
CO_2	0.0187	313.0	690.0	2817.0	6210.3
Cl	0.0028	46.9	103.3	421.8	929.9
HCl	0.2076	3474.8	7660.4	31272.8	68944.0
H	0.0002	3.3	7.4	30.1	66.4
OH	0.0002	3.3	7.4	30.1	66.4
H_2	0.0237	396.7	874.5	3570.2	7870.8
H_2O	0.0626	1047.8	2309.9	9430.0	20789.5
N_2	0.0824	1379.2	3040.6	12412.7	27365.0

Source: Adapted from [USAF 1996]

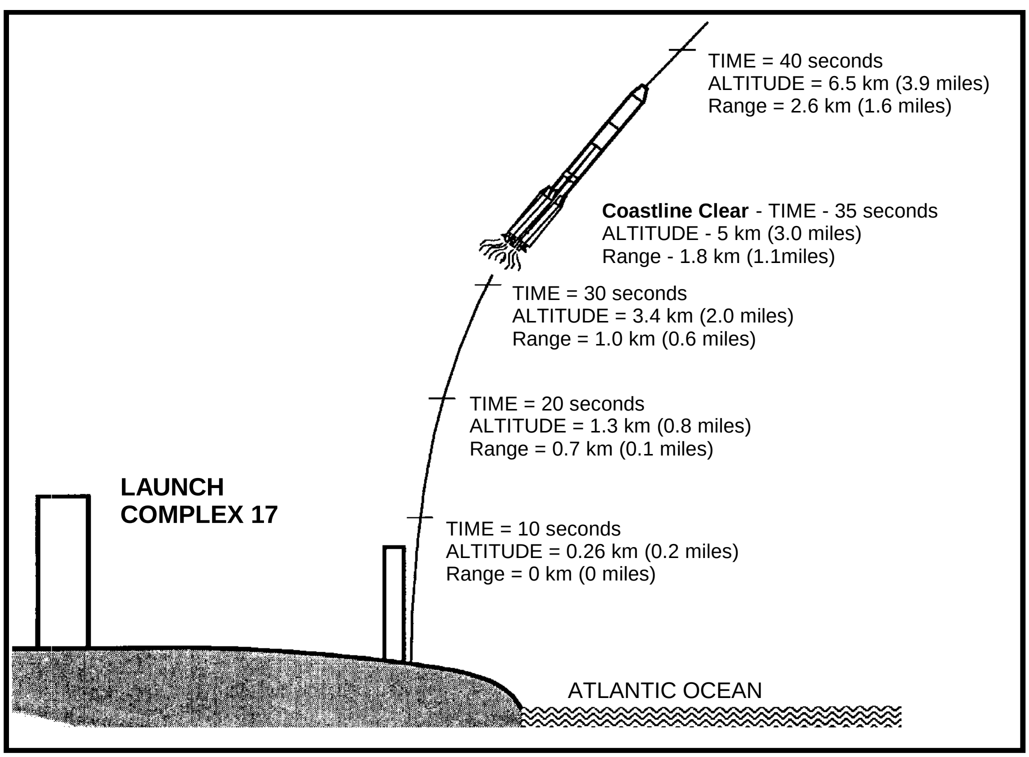
(NO_X), and water. Combustion products of the GEMs are listed in Table 4-1. Major exhaust products of the Delta II first stage will be CO, CO_2, and water. Exhaust products from the Delta II first stage are given in Table 4-2.

Table 4-2 Exhaust Products for the Delta II First Stage

Combustion Product	Mass Fraction	Product Mass kilograms	Product Mass pounds
CO	0.4278	41,173	90,580
CO_2	0.2972	28,603	62,928
H	0.0001	10	21
H_2	0.0139	1,338	2,943
H_2O	0.2609	25,110	55,242
OH	0.0002	19	42

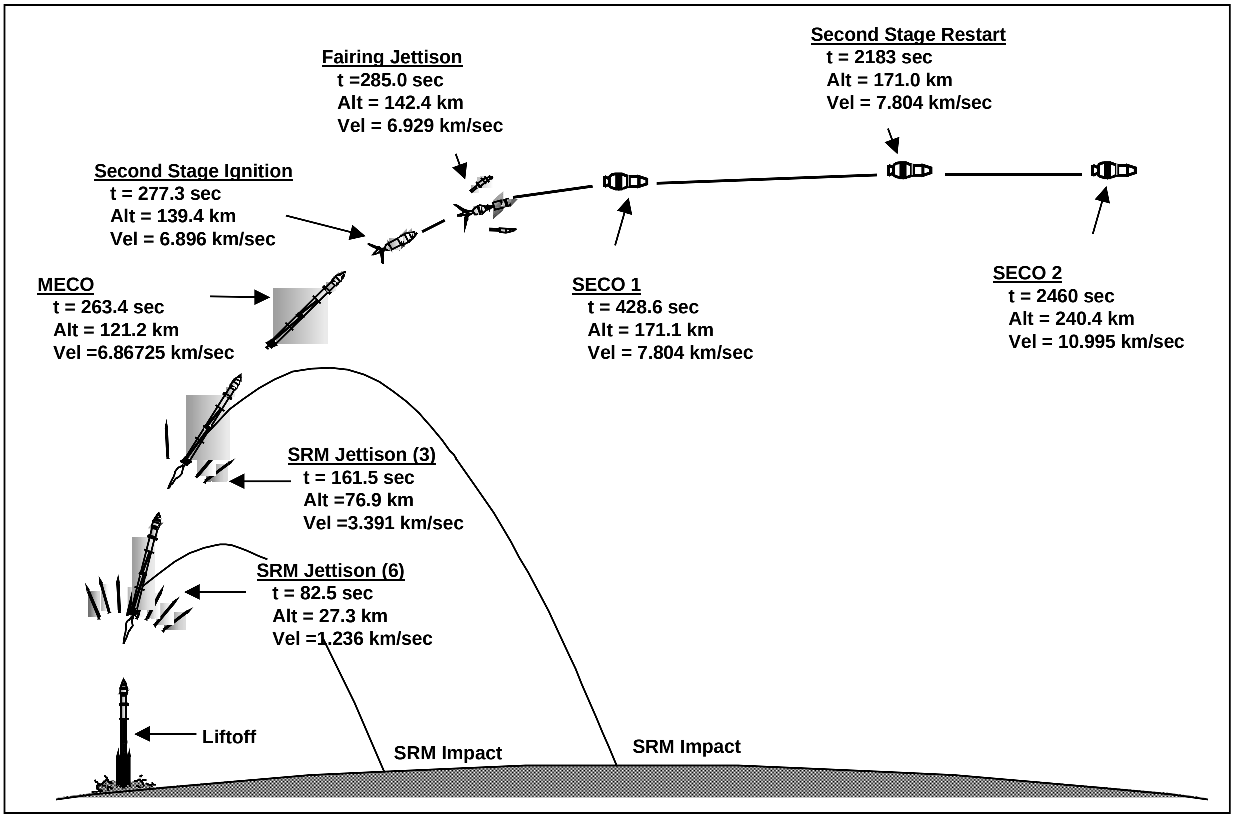
Source: Adapted from [MDSSC 1992]

In a normal launch, exhaust products from the Delta II 7920H (Tables 4-1 and 4-2) are distributed along the launch vehicle's flight path (Figures 4-1 and 4-2). The portion of the exhaust plume that persists longer than a few minutes (the ground cloud) is emitted during the first few seconds of flight and is concentrated near the pad area. It consists of the rocket exhaust effluents and deluge water. Prior to launch all personnel are evacuated from the launch site to areas a minimal distance outside the facility perimeter until the area has been monitored and declared clear. [USAF 1994]



Source: Adapted from [MDA 1993]

Figure 4-1 Delta II Boost Profile



Source: [JPL 2000]

Figure 4-2 Delta II Injection Profile for SIRTF

The Air Force uses the Rocket Exhaust Effluent Diffusion Model (REEDM) to determine the concentration and areal extent of launch cloud emission dispersion from LVs. Using Delta II 7920H mass fractions, data obtained during early Delta launches, and rocket engine chamber tests, REEDM was run to calculate peak ground level concentrations of various pollutants in ground clouds. For this assessment, Air Force personnel from 45SW ran REEDM for the Delta II 7920H LV nominal launch case (normal launch mode) in two different weather scenarios (2 runs). The model was also run for two failure modes (conflagration and deflagration) in two credible weather scenarios (4 runs). (A credible weather scenario is one in which launch would proceed.) A total of six runs were performed. The first weather scenario is a high over the eastern US, producing easterly winds that could cause adverse inland toxic hazard corridors. It features a vertically uniform wind direction with light winds from the east to southeast at speeds of approximately 7 m/s (23 ft/s) for most of the mixing layer. The light uniform winds make this scenario a case of interest for particulate deposition analyses. The second weather case is for a cold front over southern Florida, producing northerly wind components and inversions which could also cause an adverse toxic hazard corridor toward the closest and densest population center at Port Canaveral. Selected output (i.e., the highest predicted concentrations) from the model runs is included in Appendix B.

For the nominal launch scenario the launch cloud was assumed to be 100 m (328 ft) in diameter at ground level. The area directly impacted by flame from the rocket exhaust would be approximately 80 m (262 ft) in diameter. [USAF 1994] The cloud height was calculated to be a minimum of 1343 m (4403 ft) above the ground, with a minimum time of rise of about 393 seconds. [USAF 1999]

Because the cloud rises so rapidly, surface exposure to the cloud immediately after launch is assumed to occur for approximately two minutes for this analysis. The model predicted that the cloud would stabilize approximately 3 km (1.9 mi) from LC-17. Concentrations for carbon monoxide, carbon dioxide, chlorine (Cl), aluminum oxide, and hydrochloric acid were considered. The distances given in Table 4-3 relate to the position where the peak concentration is predicted to occur. For all species considered, the distance range between launch pad and the peak concentration is from 12 km to 14 km (5.7 to 8.6 mi) downwind of LC-17 for the first weather scenario and 8 to 10 km (5 to 6 mi) downwind in the second weather scenario. REEDM outputs predict that the 60-minute average concentrations would be less than 0.05 ppm for all species considered for a normal launch in either of the two weather scenarios. Even at the peak concentration of toxic effluents, appropriate health and safety exposure limits would not be exceeded, and hence no impacts are anticipated.

Table 4-3 REEDM Prediction for Normal Launch Chemical Species Concentrations#

Chemical Species	Peak Concentration (at 12 km from LC-17) (ppm)	Maximum 60-Minute Mean Concentration (at 12 km from LC-17) (ppm)	Standards
HCl	0.42	0.017	5 ppm 3 ppm ERPG^
Al_2O_3	1.878 (mg/m^3)	0.085 (mg/m^3)	15 mg/m^3*
CO	0.809	0.033	35 ppm**
CO_2	0.143	0.006	30,000 ppm STEL 10,000 ppm OSHA
Cl	0.006	No Cl found	0.5 ppm TWA; 1 ppm STEL & OSHA
N_2	0.214	0.009	NS
H_2O	0.536	0.022	NS
OH	0.001	No OH found	NS
H_2	0.928	0.038	NS
H	0.016	0.001	NS

Source: [USAF 1999]

#REEDM does not contain the ability to determine what amount of Al_2O_3 is PM-10, therefore, all of it is assumed to be PM-10 for conservatism.
^ See references for Table 4-8.
*24 hour average, Florida and Federal standards, taken from Table 3-1.
**1-hour average, Florida and Federal standards, taken from Table 3-1.
NS There is no standard for this effluent.

The Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for HCl is 5 ppm for an 8-hour time-weighted average. Although National Ambient Air

Quality Standards (NAAQS) have not been adopted for HCl, National Academy of Sciences (NAS) developed recommended short-term exposure limits for HCl of 20 ppm for a 60-minute exposure, 50 ppm for a 30-minute exposure, and 100 ppm for a 10-minute exposure. The Short-Term Public Emergency Guidance Level (SPEGL) is the acceptable standard for public exposure and environmental protection. The SPEGL for HCl is based on a ceiling concentration level of 1 ppm.

Since the nearest uncontrolled area (i.e., general public) is approximately 4.8 km (3 mi) from LC-17, HCl concentrations are not expected to be high enough to be harmful to the general population in the cases of the normal launch or deflagration scenario during the first weather scenario. The maximum level of HCl expected to reach uncontrolled areas during preparation and launch of the Delta II would be well below the NAS recommended limits. Appropriate safety measures would also be taken to ensure that the permissible exposure limits defined by the OSHA are not exceeded for personnel in the launch area.

During the last twenty years there has been an increased concern about human activities that are affecting the upper atmosphere. Space vehicles that use SRMs have been studied concerning potential contribution to stratospheric ozone (O_3) depletion because of their exhaust products, with the primary depleting component being HCl. However, rockets contribute very minor amounts of HCl to the atmosphere when compared with other human-made sources. The average global depletion rates for the types of chemicals emitted were calculated as a percent O_3 reduction per ton of exhaust emissions. The relevant depletion rates are 3.1×10^{-5} percent reduction for each metric ton (2.8×10^{-5} for each ton) of Cl emitted, 8.3×10^{-6} percent reduction for each metric ton (7.5×10^{-6} percent reduction per ton) of Al_2O_3 emitted, and 1.8×10^{-6} for each metric ton (1.6×10^{-6} per ton) of nitrogen oxides (NO_x). [Jackman 1998, JPL 1998] There are 31,695 kg (31.7 mt) (69,874 lb or 35 tons) of Cl and HCl emitted by the nine GEMs during launch, which means that each launch of a Delta 7920H vehicle would contribute an estimated 9.8×10^{-4} percent consequent global reduction in stratospheric ozone. Currently, SIRTF is the only mission using the Delta II 7920H configuration. Based on an average of twelve Delta II mixed fleet launches per year (one 7320, three 7420, seven 7920, one 7920H; for a total of 78 regular GEMs and 9 LDXL GEMs) it is estimated that a cumulative net stratospheric ozone depletion on the order of 7.1×10^{-3} percent would be due to the Cl and HCl. The Delta II second stage, common to all configurations, is estimated to release 5.4 mt (6 tons) of NO_2, which would contribute 9.6×10^{-6} percent consequent global reduction in stratospheric ozone. Launching twelve Delta IIs in a twelve-month period would result in a cumulative net stratospheric ozone depletion on the order of 1.1×10^{-4} percent due to NO_x. There are 56,851 kg (56.8 mt) (125,335 lb or 62.7 tons) of Al_2O_3 from a Delta II 7920H launch; which would contribute 4.7×10^{-4} percent reduction in stratospheric ozone. The cumulative net stratospheric ozone depletion due to Al_2O_3 resulting from the same mix of 12 Delta II configurations as listed above would be 3.2×10^{-3} percent. Thus, the total cumulative net stratospheric ozone depletion due to these exhaust products for twelve Delta II launches in a twelve-month period would be approximately 1.03×10^{-2} percent.

In addition to the near-pad acidic deposition that could occur during a launch, there is a possibility of acid precipitation from naturally-occurring rain showers falling through the ground cloud shortly after launch. Since the ground cloud for a Delta II launch is predicted to be very small (radius of about 100 m or 328 ft) [USAF 1996], concentrates around the launch pad, and disperses quickly, there should be no substantial amount of acidic deposition beyond the near-pad area.

During launch, gases are exhausted at temperatures ranging from 1093 to 1650ºC (2,000 to 3,000ºF). Most of the gases then immediately rise to an altitude of about 610 m (2,000 ft), where they are dispersed by the prevailing winds. Unprotected individuals within 100 m (327 ft) of the launch pad during a normal launch would likely be killed or injured due to heat and high levels of HCl. Prior to launch, a 2-km (6,500-ft) clear zone is established by Range Safety around the launch pad. Prior to, during, and for about twenty minutes after launch, the area within the perimeter is cleared of personnel in accordance with Range Safety practices. Additionally, a 850 m (2,780 ft) blast danger zone is established. In the event of a catastrophic launch failure, no personnel would be in the blast area. [USAF 1996]

Launch cloud CO concentrations predicted by REEDM for nominal launch mode range from 0.01 to a maximum of 0.81 ppm; CO_2 concentrations range from 0.02 to a maximum of 0.14 ppm; and, Cl concentrations range from 0.3 to a maximum of 6 parts per billion (ppb). The maximum one-hour average concentrations for these exhaust effluents were predicted to be 0.03 ppm for CO, 0.006 ppm for CO_2, and no ppm found for Cl. All maximums occurred approximately 13 km (8 mi) downwind of LC-17. The CO gas is expected to rapidly oxidize into CO_2 in the atmosphere. Although National Ambient Air Quality Standards (NAAQS) do not apply to mobile sources such as launch vehicles, they are used in this document for purposes of comparison. CO concentrations for Delta launches are not expected to exceed the NAAQS of 35 ppm (one-hour average) beyond the immediate vicinity of LC-17.

Aluminum oxide exists as a crystalline dust in SRM exhaust clouds, but is inert chemically and is not toxic. However, since many of the dust particles are small enough to be retained by lungs, NAAQS for particulate matter smaller than 10 microns (PM-10) are used here for comparison purposes. The maximum and 60-minute mean Al_2O_3 concentration (all particle sizes) predicted by REEDM for a normal launch from LC-17 during worst case meteorological conditions is 1.878 mg/m^3 at a distance of 14 km (8.7 miles) and 0.085 mg/m^3 at a distance of 15 km (8.2 miles), respectively. The maximum 24-hour average Al_2O_3 concentration is predicted to be 0.0035 mg/m^3 (3.5 µg/m^3) 15 km (8.2 miles) from LC-17, which is well below the 24-hour average NAAQS for PM-10 and PM-2.5 of 150 µg/m^3 and 65 µg/m^3, respectively.

4.1.2 Land Resources

Overall, launching a Delta II vehicle is expected to have negligible negative effects on the land forms surrounding LC-17. [USAF 1996] However, launch activities could have some small impacts near the launch pad associated with fire and acidic deposition. Minor brush fires are infrequent by-products of Delta launches, and are contained and limited to the ruderal vegetation within the launch complexes; past singeing has not permanently affected the vegetation near the pads. Wet deposition of HCl, caused by rain falling through the ground cloud or SRM exhaust, could damage or kill vegetation. Wet deposition is not expected to occur outside the pad fence perimeter, due to the small size of the ground cloud and the rapid dissipation of both the ground cloud and SRM exhaust plume. [USAF 1996]

4.1.3 Local Hydrology and Water Quality

Water, supplied by municipal sources, is used at LC-17 for deluge water (for fire suppression), launch pad washdown, and potable water. Most of the deluge and launch pad washdown water is collected in a concrete catchment basin; however, minor amounts may drain directly to grade. The only potential contaminants used on the launch pad are fuel and oxidizer, and the only release of these substances would occur within sealed trenches and should not contaminate runoff. Any accidental or emergency release of propellants from the Delta vehicle after fueling would be collected in the flume located directly beneath the launch vehicle and channeled to a sealed concrete catchment basin. If the catchment basin water meets the criteria set forth in the FDEP industrial wastewater discharge permit, it is discharged directly to grade at the launch site. If it fails to meet the criteria, it is treated on site and disposed to grade or collected and disposed of by a certified contractor. No discharges of contaminated water are expected to result from medium launch vehicle operations (MLV) at LC-17. To ensure this, the groundwater in the discharge area is monitored quarterly by Air Force Bioenvironmental Engineering Services.

The primary surface water impacts from a normal Delta II launch involve HCl and Al_2O_3 deposition from the ground cloud. The cloud will not persist or remain over any location for more than a few minutes. Depending on wind direction, most of the exhaust may drift over the Banana River or the Atlantic Ocean, resulting in a brief acidification of surface waters from HCl. Monitoring at CCAFS shows that most deposition occurred within a few hundred meters. Deposition modeling predicts that a maximum of 14,094 milligrams per square meter (0.05 oz per square feet) of HCl would be deposited approximately 1,000 meters (0.62 mile) from the launch pad. The amounts of HCl deposited could cause temporary reductions in pH in small isolated pools, but would be quickly neutralized by the carbonate minerals present in soil, bedrock, and surface water at CCAFS. [USAF 2000] Aluminum oxide is relatively insoluble at the pH of local surface waters and is not expected to cause elevated aluminum levels or significant acidification of surface waters. The relatively large volume of the two bodies of water compared to the amount of exhaust released is a major factor working to prevent a deep pH drop and fish kills associated with such a drop. A normal Delta II launch would have no substantial impacts to the local water quality. [USAF 1994]

4.1.4 Ocean Environment

In a normal launch, the first stage and GEMs will impact the ocean. The trajectories of spent first stage and GEMs would be programmed to impact a safe distance from any U.S. coastal area or other land mass. Toxic concentrations of metals are not likely to occur due to the slow rate of corrosion in the deep ocean environment and the large quantity of water available for dilution.

Since the first stage and GEMs will be burned to depletion in-flight, there would be relatively small amounts of propellant. The release of solid propellants into the water column would be slow, with potentially toxic concentrations occurring only in the immediate vicinity of the propellant. Insoluble fractions of the first stage propellant would spread rapidly to form a localized surface film that will evaporate in several hours. Second stage propellants are soluble and should also disperse rapidly.

No substantial impacts are expected from the reentry and ocean impact of spent stages, since the small amount of residual propellants will quickly disperse. [USAF 2000]

4.1.5 Biotic Resources

A normal Delta II launch is not expected to substantially impact CCAFS terrestrial, wetland, or aquatic biota. The elevated noise levels of launch are of short duration and would not substantially affect wildlife populations. Wildlife encountering the launch-generated ground cloud may experience brief exposure to exhaust particles, but would not experience any significant impacts. Aquatic biota may experience acidified precipitation, if the launch occurs immediately after a rain shower. This impact is expected to be insignificant due to the brevity of the ground cloud and the high buffering ability of the surrounding surface waters to rapidly neutralize excess acidity.

4.1.6 Threatened and Endangered Species

Any action that may affect federally listed species or their critical habitats requires consultation with the U.S. Fish and Wildlife Service (FWS) under Section 7 of the Endangered Species Act of 1973 (as amended). The U.S. FWS has reviewed the actions which would be associated with a Delta II launch from LC-17 and has determined that those actions would have no effect on state or federally listed threatened (or proposed for listing as threatened) or endangered species residing on CCAFS and adjoining waters. [NASA 1997-A, USAF 1996]

4.1.7 Developed Environment

4.1.7.1 Population and Economics

Launching the SIRTF mission will have a negligible impact on local communities, since no additional permanent personnel are expected beyond the current CCAFS staff. LC-17 has been used exclusively for space launches since the late 1950s. The SIRTF mission would cause no additional adverse impacts on community facilities, services, or existing land uses.

4.1.7.2 Safety and Noise Pollution

EWR 127-1 identifies design and operating limits that would be imposed on system elements to preclude or minimize accidents resulting in damage or injury. Normal operations at

CCAFS include preventative health measures for workers such as hearing protection, respiratory protection, and exclusion zones to minimize or prevent exposure to harmful noise levels or hazardous areas or materials.

The engine noise and sonic booms from a Delta II launch are typical of routine CCAFS operations. To the surrounding community, noise from launch-related activity appears, at worst, to be an infrequent nuisance rather than a health hazard. In the history of the USAF space-launch vehicle operations from CCAFS, there have been no problems reported as a result of sonic booms, most probably because the ascent track of all vehicles and the planned reentry of spent suborbital stages are over Coast Guard controlled open ocean, thus placing sonic booms away from land areas. Shipping in the area likely to be affected is warned of the impending launches as a matter of routine, so that all sonic booms are expected and of no practical consequence. [USAF 2000] Figure 4-3 shows the noise generated by a Delta II 7925 launch. The Delta II 7920H produces higher sound level due to the larger SRMs. It would be launched from the LC-17B, which has been modified with water suppression to reduce the sound level to be comparable with the Delta II 7925.

4.1.7.3 Pollution Prevention

The Joint Group on Pollution Prevention (JG-PP) is the successor to the former Joint Group on Acquisition Pollution Prevention (JG-APP). The JG-PP is a partnership between various government organizations, including the USAF and NASA, to assist in validating and implementing materials and processes that are less hazardous than those currently used in military and industrial facilities. As a NASA mission launching from CCAFS, the SIRTF mission would meet JG-PP pollution prevention guidelines. [JG-PP 2001, NASA 1999-A, NASA 1999-B, USAF 2000]

4.1.7.4 Environmental Justice

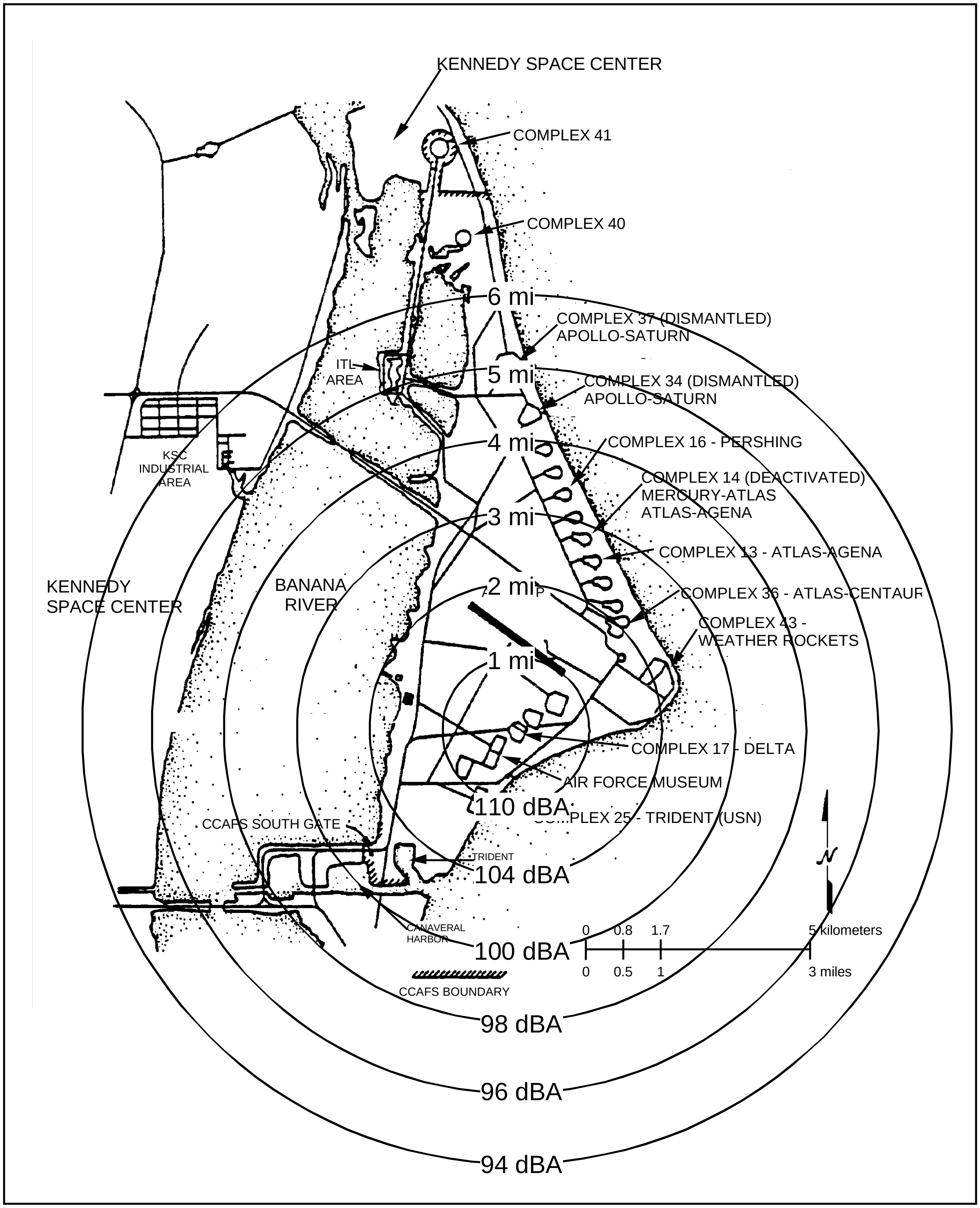
EO 12898 directs Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on low-income populations and minority populations. Given the launch direction and trajectories of the SIRTF mission, analysis indicates little or no potential of substantial environmental effects on any human populations outside CCAFS boundaries. (See Section 3.1.1 for a discussion of the population distribution of the region of interest.) The SIRTF launch would not result in disproportionate adverse impacts on low-income or minority populations [NASA 1999-C].

4.1.7.5 Cultural Resources

Since no surface or subsurface areas would be disturbed, no significant archaeological, historic, or other cultural sites are expected to be affected by launching the SIRTF spacecraft.

4.1.7.6 Cumulative Impacts

CCAFS accommodates various ongoing space programs. The environmental effects associated with these programs have been included in the baseline environmental conditions described in section 3. Cumulative effects on ozone depletion are discussed in section 4.1.1.1. [USAF 1994, USAF 2000]



Source: Adapted from [USAF 1996]

Figure 4-3 Noise Generated by a Delta II 7925 Launch from LC-17

4.2 ACCIDENTS AND LAUNCH FAILURES AT CCAFS

4.2.1 Liquid Propellant Spill

The potential for an accidental release of liquid propellants will be minimized by strict adherence to established safety procedures. First stage propellants, RP-1 and liquid oxygen, will be stored in tanks near the launch pad within cement containment basins designed to retain 110 percent of the storage tank volumes. Post-fueling spills from the launch vehicle would be channeled into a sealed concrete catchment basin and disposed of in accordance with 45SW OPlan 32-3. Second stage propellants, Aerozine 50 and N_2O_4, are not stored at LC-17 and would be transported to the launch site by specialized vehicles. [USAF 1994]

The most severe propellant spill accident scenario would be releasing the entire launch vehicle load of N_2O_4 at the launch pad while conducting propellant transfer operations. This scenario would have the greatest potential impact on local air quality. Using the Titan REEDM predictive models and scaling for the Delta propellant loading, airborne NO_x levels from this scenario should be reduced to 5 ppm within about 150 m (492 ft) and to 1 ppm within 300 m (984 ft). Activating the launch pad water deluge system would substantially reduce the evaporation rate, limiting exposure concentrations in the vicinity of the spill that are above federally established standards. Propellant transfer personnel would be outfitted with protective clothing and breathing equipment. Personnel not involved in transfer operations would be excluded from the area during such operations.

4.2.2 Launch Failures

In the unlikely event of a launch vehicle destruction, either on the pad or in-flight, the liquid propellant tanks and SRM cases would be ruptured. Due to their hypergolic (ignite on contact) nature, a launch failure would result in a spontaneous burning of 10 to 30 percent of the liquid propellants, and a somewhat slower burning of SRM propellant fragments. [USAF 1997-A]

Tables 4-4 and 4-5 define the combustion products of a GEM SRM failure (conflagration) and the REEDM predictions for chemical species concentrations of interest, respectively. These maximum concentrations are predicted to occur approximately 2 km (1.2 mi) downwind of LC-17, for the worst credible weather scenarios. The maximum 60-minute mean concentrations are predicted to also occur approximately 2 km (4 mi) downwind. In the worst case scenario, which is a conflagration event in the second meteorological case, the maximum concentrations for HCl are predicted to be 24.6 ppm, which occurs 3 km (2 mi) from the launch pad. However, the conflagration products would rapidly disperse at altitude so that the peak concentration would be reduced within 30 minutes to less than 5 ppm at a distance of 10 km from the pad. The maximum one-hour concentration for HCl was predicted by REEDM to be 1.4 ppm at 3 km (2 mi) downwind of LC-17.

Table 4-4 Combustion Products for Delta II 7920H GEM Failure Scenario (Conflagration - a failure mode in which there is burning of the solid propellants)

Combustion Product	Product Mass Fraction	Total Propellant Mass of 151749 kg (334549 lb)	
		kg	lb
Al_2O_3	0.1759	26693	58847
Ar	0.0064	971	2141
C	0.0143	2170	4784
CH_4	0.0000	0	0
CO_2	0.1329	20167	44462
Cl_2	0.0000	0	0
HCl	0.1071	16252	35830
H_2O (liquid)	0.1274	19333	42622
H_2O (gaseous)	0.0136	2064	4550
N_2	0.4188	63552	140109
O_2	0.0000	0	0

Source: Adapted from [MDSSC 1992]

Table 4-5 REEDM Prediction for Conflagration Chemical Species Concentrations

Chemical Species	Peak Concentration (at 2 km from LC-17) (ppm)	Maximum 60-Minute Mean Concentration (at 2 km from LC-17) (ppm)
HCl	24.261	1.405
Al_2O_3	112.267 (mg/m^3)	10.908 (mg/m^3)
CO	39.915	2.311
CO_2	6.176	0.358
Cl	7.915	0.458
N_2	76.369	4.422
H_2O	42.004	2.432
OH	7.113	0.412
H_2	36.916	2.137
O	2.057	0.119
AlOCl	0.408	0.024
NO	1.047	0.061

Source: [USAF 1999]

Tables 4-6 and 4-7 define the combustion products of a catastrophic launch pad failure (deflagration), wherein there is burning of the hypergolic propellants, and the REEDM predictions for chemical species concentrations resulting from the deflagration, respectively.

Although much of the hypergolic propellants would be burned in either failure mode, emissions would include the constituents from a normal launch and dispersed propellants, including N_2H_4. Any N_2O_4 that does not react with other propellants is predicted by REEDM to convert to NO_2 in the fireball chemical reactions. The health hazard quantities of these chemicals are summarized in Table 4-8. It is predicted that this release of pollutants would have only a short-term impact on the environment near LC-17.

Table 4-6 Combustion Products for Delta II 7920H Catastrophic Failure Scenario (Deflagration-a failure mode in which there is burning of the hypergolic propellants.)

Combustion Product	Product Mass Fraction	Total Propellant Mass of 255019 kg (562215 lb)	
		kg	lb
Al_2O_3	0.1077	27463	60546
Ar	0.0064	1634	3602
C	0.0183	4656	10265
CO_2	0.2304	58749	129517
Cl_2	0.0000	0	0
HCl	0.0645	16453	36273
H_2O (liquid)	0.1507	38433	84728
H_2O (gaseous)	0.0140	3577	7886
N_2	0.4080	104055	229399
O_2	0.0000	0	0

Source: Adapted from [MDSSC 1992]

Table 4-7 REEDM Prediction for Deflagration Chemical Species Concentrations

Chemical Species	Peak Concentration (at 7 km from LC-17) (ppm)	Maximum 60-Minute Mean Concentration (at 8 km from LC-17) (ppm)
HCl	0.221	0.009
Al_2O_3(A)	0.175	0.007
CO	5.113	0.201
CO_2	Not significant	Not significant
Cl	none	None
NO_2	0.413	0.016
NH_3	0.16	0.006
N_2H_4	0.01	no N2H4 found
UDMH	Negligible*	Negligible*

Source: [USAF 1999]

*due to increased combustion with solid propellants and the higher elevations of the resulting plume, amount of UDMH is considered to be negligible. [USAF 1999]

Table 4-8. Health Hazard Quantities of Hazardous Launch Emissions

Compound	ERPG (ppm)			EEGL (ppm)	SPEGL (ppm)	PEL (ppm)	STEL (ppm)	TLV (ppm)	IDLH (ppm)
	1	2	3						
Dimethyl Hydrazine (UDMH)	0.03	8	80	0.24 for 1 hr 0.12 for 2 hr 0.06 for 4 hr 0.03 for 8 hr 0.015 for 16 hr 0.01 for 24 hr	24 for 1 hr 1 for 24 hr	0.5 (skin)		0.01 (skin)	15
Hydrazine (N_2H_4)	0.03	8	80		0.12 for 1 hr 0.06 for 2 hr 0.03 for 4 hr 0.015 for 8 hr 0.008 for 16 hr 0.005 for 24 hr	1 (skin) (1.3 mg/m^3)		0.01 (skin)	50 (66 mg/m^3)
Hydrochloric Acid or Hydrogen Chloride (HCl)	3	20	150	100 for 10 min 20 for 1 hr 20 for 24 hr	1 (ceiling)	5 (ceiling)		5 (ceiling)	50
Nitrogen Tetroxide as NO_2				1 for 1 hr (ceiling) 0.04 for 24 hr (ceiling)	1 for 1 hr 0.5 for 2 hr 0.25 for 4 hr 0.12 for 8 hr 0.06 for 16 hr 0.04 for 24 hr	5 (ceiling)		5 (STEL) 3 (TWA)	20
Ammonia (NH_3)	25	150	750			50	35	25	300
Nitric Acid (HNO_3)	4	10	100			2	4	2	25
Nitrogen Dioxide (NO_2)*				1 for 1 hr (ceiling) 0.04 for 24 hr (ceiling)	1 for 1 hr 0.5 for 2 hr 0.25 for 4 hr 0.12 for 8 hr 0.06 for 16 hr 0.04 for 24 hr	5 (ceiling)		5 (STEL) 3 (TWA) (0.013 mg/m^3)	20
Aluminum Oxide (Al_2O_3)	15 mg/m^3	15 mg/m^3	15 mg/m^3	50 mg/m^3 for 10 min 25 mg/m^3 for 30 min 15 mg/m^3 for 60 min					
Beryllium	NA	0.025 mg/m^3	0.1 mg/m^3						

Source: [USAF 1994, EPA 1999, USAF 2000, NIOSH 1995, DOE 2001]

ERPG Emergency Response Planning Guidelines - Developed by the American Industrial Hygiene Association, ERPGs are the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour: ERPG-1 - without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor; ERPG-2 - without experiencing or developing irreversible or other serious health effects of symptoms that could impair their abilities to take protective action; and ERPG-3 - without experiencing or developing life-threatening health effects.

EEGL Emergency Exposure Guidance Level - Advisory recommendations from the National Research Council (NRC) for the Department of Defense (DoD) for an unpredicted single exposure.

SPEGL Short-term Public Emergency Guidance Level - Advisory recommendations from the NRC for the DoD for an unpredicted single exposure by sensitive population.

PEL Permissible Exposure Limit - Occupational Safety and Health Administration (OSHA) standards averaged over 8-hour period, except for ceiling values which may not be exceeded in the workplace.

STEL Short Term Exposure Limit - OSHA standards averaged over 15-minute period in the workplace.

TLV Threshold Limit value - Recommendations of the America Conference of Governmental Industrial Hygienists. The TLV is the airborne concentration of the substance which represent conditions under which it is believed nearly all workers may be repeatedly exposed to day after day without adverse effect. There are three categories of TLVs: 1) Time Weighted Average (TWA) is the concentration of a normal 8-hour work day or 40-hour week; 2) STEL is the maximum concentration to which workers can be exposed for a period of up to 15 minutes; and 3) ceiling is the concentration that should not be exceeded even instantaneously.

IDLH Immediately Dangerous to Life or Health - Air concentration at which an unprotected worker can escape without debilitating injury or health effect.

*National primary and secondary ambient air quality standard for nitrogen dioxide - annual arithmetic mean for nitrogen dioxide (NO_2) is 0.053.

For a deflagration scenario, additional species such as UDMH, nitrogen dioxide (NO_2), ammonia (NH_3), hydrazine (N_2H_4), nitrosodimethylamine (NDMA), formaldehyde (FDH), and nitric acid (HNO_3) were considered. REEDM assumes about 5 percent of the solid propellants would be involved in the deflagration scenario fireball reactions. REEDM predicted that there would be no FDH, NDMA, UDMH, or HNO_3 found in the ground cloud. The maximum concentrations and 60-minute mean concentrations predicted by REEDM for the worst weather scenario are shown in Table 4-7. These peak concentrations were predicted to occur approximately 7 km (4 mi) downwind of LC-17. Maximum 60-minute mean concentrations resulting from deflagration are predicted to occur approximately 8 km (5 mi) downwind.

The SIRTF telescope primary mirror, the secondary mirror, adapter tube, metering tower, and inner diameter aperture stop would be fabricated from a special grade of I-70H beryllium (Be) developed for cryogenic applications. The total quantity of Be in the telescope assembly would be 25.8 kg (56.9 lb). This assembly would be housed inside three layers of aluminum on the sides and one layer on the top. The telescope assembly is a heritage design of the Infrared Astronomical Satellite (IRAS) mission flown in 1983. [JBIS 1983]. Beryllium has been baselined because it is lightweight and has predictable and repeatable thermal behavior at cryogenic temperatures. Silicon carbide and quartz were alternate materials considered in the early formulation phase, but were rejected because these materials are not suitable for the telescope structure and would increase the telescope assembly mass by at least fifty percent. Using a different material, such as aluminum, for structural support would create differences in thermal expansion that could cause misalignment of the telescope and instruments at cryogenic temperatures. Since the Be mirror construction was a technology proven with the IRAS mission, the SIRTF mission has adopted a similar design.

The question arises as to whether a catastrophic launch scenario might result in vaporization of the beryllium. There is no solid propellant motor in close proximity to the SIRTF spacecraft in the Delta II 7920H launch system, nor does the SIRTF spacecraft have any on-board propellant. A credible accident scenario for vaporization of the Be mirror would be the case in which a large burning solid propellant fragment from the strap-on solids impacts directly on or lands in close proximity to the mirror housing. The boiling point of Be is 3243K (2970 deg C, 5378 deg F) [CF 2001]. According the REEDM analysis, the temperature of the conflagration and deflagration scenarios involving LDXL GEMs is conservatively predicted to be a maximum of 3044 K [USAF 1999]. Therefore, it is expected that in the highly unlikely event such an accident did occur, a burning solid propellent fragment near or on top of the Be mirror housing would not be hot enough to vaporize the beryllium.

A credible accident scenario could be that the second stage fails to achieve escape velocity. Analysis performed for the Stardust orbital debris analysis shows that the probability for this failure is 0.0000587 [JPL 1999]. Since SIRTF uses an equivalent Delta II second stage, the probability of such failure also applies to SIRTF. In this scenario, a timer would cause separation of the second stage from the SIRTF Observatory. The SIRTF Observatory would then decay from an altitude of about 170 km, and would re-enter the Earth's atmosphere within a few days. This accidental re-entry was studied [JPL 2001] by examining the re-entry heating of various components of the SIRTF Observatory using various entry angles, attitude, and duration for various components to breakup. The study found that during re-entry, the SIRTF Observatory would achieve an attitude with the center of mass ahead of the center of pressure that allows the aluminum telescope outer-shell, vapor cool shield, and the spacecraft bus to act as thermal protection material. After these outer components have failed, the vacuum shell and helium tank would continue to protect the beryllium mirror so that by the time these inner components have failed, the mirror would have reached sub-sonic speed at about 3000 second from re-entry, and the mirror temperature would not have exceeded ambient temperature. Thereafter, the components that survived re-entry would impact the Earth. The point of impact would be unpredictable. The possible regions that may be impacted are the Pacific, Atlantic, and Indian Oceans, the mid continental areas of America and African, southern Asia, and northern Australia. These possible regions are composed of 75 percent ocean. The immediate area affected by the impact would be within a few square meters. Considering the probability of this launch failure mode, the ratio of land to ocean area, the ratio of populated to unpopulated area, and the small footprint of the affected area, the overall probability of injury to a person would be extremely small.

Launch failure impacts on water quality would stem from unburned liquid propellant being released into CCAFS surface waters. For most launch failures, propellant release into surface waters will be substantially less than the full fuel load, primarily due to the reliability of the vehicle destruct system.

In the event of an anomaly on the launch pad, any unburned solid-propellant dispersed by the explosion would not be likely to reach surface waters. In the event of an anomaly after launch but still near the ground, unburned propellant could fall on surface waters. Ammonium perchlorate in the solid propellant is soluble in water, but dissolves slowly. Trace amounts could disassociate into ammonium and perchlorate ions. At low to moderate concentrations, the ammonium ion is a plant nutrient and could stimulate plant growth for short periods of time. At higher concentrations, the ammonium ion is toxic to aquatic life and could cause short-term mortalities of aquatic animals. The perchlorate ion is moderately toxic, because it reacts with (oxidizes) organic matter with which it comes into direct contract. Hydroxyl-Terminated Polybutediene (HTPB) could be biologically degraded over time. Powdered aluminum would rapidly oxidize to aluminum oxide, which is non-toxic at the pH that prevails in surface waters surrounding CCAFS. [USAF 2000]

Under normal or catastrophic launch scenarios, concentrations would not be hazardous except in the immediate vicinity of the launch pad for approximately two minutes after launch or near the centroid of the launch cloud for a short time after the launch. The launch cloud would be several hundred meters above ground level, depending on weather conditions. These hazardous concentrations near the centroid of the launch cloud would persist for an estimated ten minutes, but could occur for shorter or longer periods depending on meteorological conditions. Airplanes are not allowed near the CCAFS area during launches. Prior to launch, personnel are cleared from the areas where potentially hazardous concentrations would occur, and there should be no hazard to humans associated with exhaust effluents.

For the propellants that would be dispersed to the air in the event of a catastrophic launch failure, hazardous concentrations would not occur except in the immediate vicinity of the launch complex. Since personnel will be cleared from the area prior to launch, there would be no hazard to humans from dispersed propellants in the event of a catastrophic launch failure.

Since Immediately Danger to Life or Health standards (IDLHs), Permissible Exposure Limits (PELs), Short Term Exposure Limits (STELs), and Threshold Limit Values (TLVs) are established considering potential exposure of workers, they should not be used for evaluating the potential health significance of accidental release that may impact the general population. They are, however, included here since personnel at CCAFS will be transferring and loading fuel at the pad prior to launch. The recommended guidelines used to determine safe exposure limits for the general population are the Emergency Response Planning Guidelines (ERPGs), developed by the American Industrial Hygiene Association (AIHA). The endpoint for a toxic substance is its ERPG level 2 (ERPG-2), developed by the AIHA (Section 112r of the Clean Air Act). [ERPG 1997] None of the concentrations predicted by REEDM for catastrophic launch aborts of the Delta II at CCAFS exceeded the ERPG-2 values except in the immediate vicinity of the launch pad.

A Delta II 7925 anomaly occurred on January 17, 1997 at CCAFS as a result of a GEM breaking apart during flight. When the launch vehicle exploded, approximately 2,500 pieces of solid propellant, many burning, and 2,100 fragments of the launch vehicle were scattered within a mile radius on and around LC-17. These firebrands resulted in small fires throughout the Flight Hazard Area. The airlit GEMs were not pressurized, and broke into several major pieces, which impacted intact and caused a number of secondary explosions, craters, and firebrands. In addition, a cloud containing a small amount of RP-1 rocket fuel was generated. Numerous ground level secondary explosions resulted due to solid propellant and debris impacting the ground. Range radar reported tracking debris in the local area for nearly 30 minutes after the explosion. All debris impacted within predefined areas. [USAF 1997-B] The vast bulk of the plume generated by the explosion was out over water; and maximum concentrations of HCl and NO_2 were both 1 to 2 ppm. A slight wisp at the surface may have blown on-shore at concentrations below detection. A large buoyant and visible plume covered much of southern Brevard County and Indian River County at high altitude. No aspect of this plume was hazardous. The Flight Termination Systems (FTSs) proved able to prevent a hazard to the public. [USAF 1997-A, USAF 1997-B]

As a result of this launch accident, CCAFS has implemented the following new policies: there will be a Brevard County Emergency Management Center (BEMC) representative at the launch console two hours before launch, to provide county officials with immediate access to information about the content of clouds and their direction; and the Air Force has installed direct audio and video communications lines from its control center to BEMC, to ensure open communication lines to the Rockledge emergency bunker, the site from which county officials broadcast emergency alerts. The Air Force has also installed a direct emergency phone line to the Florida State Emergency Response Center. [USAF 1997-A, USAF 1997-B]

4.3 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

4.3.1 Alternative Launch Vehicles

Of the alternate launch vehicle systems available, all greatly exceed the SIRTF mission requirements. The Atlas II would generate less adverse potential environmental effects, however, its cost to launch would prohibit the launch of this cost-capped mission. All other launch vehicle alternatives would generate potentially comparable or greater environmental impacts.

4.3.2 No-Action Alternative

The No-Action alternative would result in termination of the mission, which would disrupt the progress of NASA’s Great Observatory and Origins Programs. The SIRTF mission is the culmination of more than a decade’s planning to extend our knowledge of our solar system, our galaxy, and the Universe. The No-Action alternative would eliminate or delay the acquisition of scientific knowledge of our solar system, our galaxy, and the Universe. In preparation for SIRTF, the infrared astronomical community and NASA have invested more than ten years of technology development in infrared detectors. The No-Action alternative would prevent the application of these large format IR detectors in the advancement of science. The No-Action alternative would also delay or prevent the validation of technologies critical to future astrophysical missions. These technological areas include the use of lightweight mirror, the warm launch architecture, the Earth escape orbit without the need of a propulsion system, and the high data-rate deep space communication. While minimal environmental impacts would be avoided by cancellation of the single launch, the loss of the scientific knowledge and database that could lead to future technological advances would be substantial.

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SECTION 5
REGULATORY REVIEW

5.1 AIR QUALITY

The Florida Department of Environmental Protection (FDEP) regulates air pollutant emission sources in Florida and requires permits for the construction, modification, or operation of potential air pollution sources [FDEP 1999]. Emissions from mobile sources, such as aircraft and space launch vehicles, do not require a permit. This exception does not include support facilities, such as propellant loading systems.

Stationary, ground-based sources associated with space vehicle launches are subject to FDEP review. Because no new stationary sources would be constructed for the SIRTF launch, there is no requirement for new air quality permits.

The Delta II oxidizer and fuel vapor air pollution control devices at Cape Canaveral Air Force Station (CCAFS) are in compliance with NAAQS standards and FDEP regulations. The citric acid scrubber for Delta II propellants is probably one level of control beyond that required by the FDEP.

5.2 WATER QUALITY

5.2.1 Stormwater Discharge

Florida's stormwater discharge permitting program is designed to prevent adverse effects on surface water quality from runoff. A discharge permit would not be required for SIRTF because the launch would not increase stormwater runoff rates or reduce the quality of the existing runoff.

5.2.2 Sanitary and Industrial Wastewater discharge

LC-17 and the areas of Kennedy Space Center (KSC) where the SIRTF Observatory would be checked out, as well as the launch vehicle assembly facilities on CCAFS have potable water and sanitary waste disposal permits. No new permits would be required for the SIRTF Observatory assembly at KSC or launch at CCAFS.

Wastewater from LC-17 would include deluge and pad washdown water discharged during SIRTF launch activities. An application has been filed with the FDEP to permit discharge from LC-17 for all launches occurring from that pad. The permit is issued based on demonstration that discharge would not significantly degrade surface or ground water.

5.2.3 Floodplains and Wetlands

LC-17 is not located on a floodplain. Impacts to wetlands from the launch of the SIRTF would not exacerbate impacts from other CCAFS activities or launches. Therefore, no new permits would be required for the SIRTF launch.

5.3 HAZARDOUS WASTES

CCAFS has Resource Conservation and Recovery Act (RCRA), Part B Hazardous Waste Operations and Hazardous Waste Treatment, Storage, or Disposal (TSD) facility permits [USAF 1998, USAF 2000]. All hazardous wastes generated at CCAFS will be managed according to the CCAFS Petroleum Products and Hazardous Waste Management Plan (OPlan 19-14). Hazardous wastes produced during processing and launch operations will be collected and stored in hazardous waste accumulation areas before being transferred to a hazardous storage area. These wastes will eventually be transported to an off-station licensed hazardous waste treatment/disposal facility.

5.4 SPILL PREVENTION

To prevent oil or petroleum discharges into U.S. waters, a Spills Prevention, Control, and Countermeasures Plan (SPCCP) is required by the Environmental Protection Agency's oil pollution prevention regulation. A SPCCP has been integrated into the 45th SW Hazardous Materials Response Plan (OPlan 32-3). Spills of oil or petroleum products that are federally listed hazardous materials will be collected and removed for proper disposal by a certified contractor according to 45SW OPlan 19-4, Hazardous Substance Pollution Contingency Plan. All spills/releases will be reported to the host installation per OPlan 32-3.

5.5 COASTAL MANAGEMENT PROGRAM

The Federal Coastal Zone Management Act of 1972 established a national policy to preserve, protect, develop, restore, and/or enhance the resources of the nation's coastal zone. The Act requires federal agencies that conduct or support activities directly affecting the coastal zone, to perform these activities in a manner that is, to the maximum extent practicable, consistent with approved state coastal zone management programs.

Delta II launches from LC-17 have been demonstrated to be consistent to the maximum extent practical with the State of Florida's Coastal Management Program, based on compatible land use, absence of significant environmental impacts and compliance with applicable regulations. [USAF 1996] SIRTF mission processing and launch would add no substantial impact beyond those determined to be associated with the Delta II launch program.

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Appendix A

CORRESPONDENCE WITH STATE AND FEDERAL AGENCIES

This appendix contains the comments received from Federal and Florida State Agencies. Where no other agency written response is provided in this appendix, none was received.

NOTE:

While preparing this Environmental Assessment, NASA solicited comments from a range of Federal and Florida State Agencies. A distribution list may be found at the end of the NASA Letter of Intent dated September 23, 1997. There will be formal correspondence with Patrick Air Force Base and Kennedy Space Center.

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National Aeronautics and
Space Administration

Headquarters
Washington, DC 20546-0001

RECEIVED
OCT 10 1997
L. L. SIMMONS

SEP 23 1997

Reply to Attn of: SD

To Potentially Concerned Agencies:

NASA is seeking approval for plans to launch the Space Infrared Telescope Facility (SIRTF) Observatory. The SIRTF Observatory is composed of three instruments, a cryo-telescope assembly, and a spacecraft. The mission would conduct astronomical observations in a wavelength range of 3 to 180 microns. SIRTF would be the last of the NASA Great Observatories, following the Hubble Space Telescope, the Compton Observatory, and the Advanced X-ray Astronomical Facility. SIRTF would study the evolution of the early universe and the interaction of galaxies, search for hidden matter and planetary systems within our own galaxy, and demonstrate new technology in long-life lightweight cryogenic systems in space for future astronomical missions. In accordance with NASA policy and procedural requirements of the National Environmental Protection Act (NEPA), NASA is preparing an Environmental Assessment (EA) to evaluate any mission specific environmental impacts. The EA is expected to be available for agency review in 1998.

The SIRTF Observatory baseline plan calls for the Observatory to be launched on the Delta 7920H launch vehicle from the Eastern Test Range at Cape Canaveral Air Station, Cape Canaveral, Florida. The 7920H is a 2-stage version of the commercial Delta II with the high performance solid motor strap-on boosters shared with the commercial Delta III. The baseline launch trajectory uses a direct ascent profile with no coasting. The second stage would directly inject the SIRTF Observatory into an Earth escape trajectory. The escape trajectory places the Observatory into a heliocentric orbit that trails the Earth with a receding rate of 0.1 AU per year. Unlike planetary launches, there is no restriction on the SIRTF launch period. The planned launch date is December 1, 2001.

The SIRTF Observatory would use solar panel and battery for power, nitrogen gas for reaction control, and liquid helium for telescope and instrument cooling. There would be no propulsion system and no radioactive material onboard the Observatory. There would be no new or modified Government or contractor facilities needed to process the Observatory at the launch complex.

The SIRTF Environmental Assessment will address the Proposed Action of preparing for and implementing the SIRTF mission to be launched from the Cape Canaveral Air Station using the Delta 7920H launch system. Alternatives discussed will include, but not necessarily be limited to, the use of alternative launch vehicles, other potential ways of meeting the purpose and need, and the "no action" alternative.

The primary thrust of the EA will be to address environmental impacts related to the proposed actions of preparing for and implementing the launch and operation of NASA's SIRTF project. The primary anticipated environmental impacts are those associated with the launch vehicle. Those effects include the impact of rocket fuel combustion products on the quality of air, water, land and wetland, biotic resources, and historical sites. Ongoing activities to monitor or protect endangered and protected species from the effects of a Delta II launch will be described. Other topics to be addressed in the environmental assessment include, but will not necessarily be limited to: noise pollution; solid wastes, toxic substances, and hazardous wastes; endangered species; historical resources; and health and safety for the general populace.

Any comments you may presently have should be sent within 30 days of the date of this letter to:

Dr. Johnny Kwok
Mail Stop 126-304
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109
(818) 354-6776

Sincerely,

Kenneth W. Ledbetter

Kenneth W. Ledbetter
Director
Mission and Payload Development Division
Office of Space Science

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JPL/126-304/L. Simmons

Federal Agencies:

Federal Emergency Management Agency
U.S. Department of the Air Force
U.S. Department of Commerce NOAA Regional Offices
U.S. Department of the Interior Fish and Wildlife Service Regional and Local Offices, including the Merritt Island National Wildlife Refuge
U.S. Department of the Interior National Park Service Canaveral (for National Seashores)
U.S. Environmental Protection Agency Region V
U.S. Department of Health and Human Services - Centers for Disease Control
U.S. Department of the Air Force-HQ Space Systems Division (AFSC)
U.S. Air Force - Patrick Air Force Base
KSC/Environmental Management Office/DE-EMO
Eastern Test Range/45th Space Wing/XP
Eastern Test Range/Civil Engineering/45 CES/CEV

State Agencies (Florida):

Florida State Clearinghouse
St. Johns River Water Management District

STATE OF FLORIDA
DEPARTMENT OF COMMUNITY AFFAIRS
"Helping Floridians create safe, vibrant, sustainable communities"

LAWTON CHILES
Governor

JAMES F. MURLEY
Secretary

December 15, 1997

Mr. Johnny Kwok
National Aeronautics and Space Administration
Jet Propulsion Laboratory
Mail Stop 126-304
Pasadena, California 91109

RE: National Aeronautics and Space Administration Projects - NASA - Scoping Letter - Proposed Launch of the Space Infrared Telescope Facility (SIRTF) Observatory - Statewide
SAI: FL9710160748C

Dear Mr. Kwok:

The Florida State Clearinghouse, pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 95-359, the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended, has coordinated a review of the above-referenced project.

Based on the information contained in the scoping letter and the enclosed comments provided by our reviewing agencies, the state has determined that, at this stage, the above-referenced project is consistent with the Florida Coastal Management Program (FCMP). All subsequent environmental documents prepared for this project must be reviewed to determine the project's continued consistency with the FCMP. The state's continued concurrence with the project will be based, in part, on the adequate resolution of issues identified during this and subsequent reviews. Comments received from several of the Regional Planning Councils are also enclosed for your review.

2555 SHUMARD OAK BOULEVARD • TALLAHASSEE, FLORIDA 32399-2100
Phone: 850.488.8466/Suncom 278.8466 FAX: 850.921.0781/Suncom 291.0781
Internet address: http://www.state.fl.us/comaff/dca.html

FLORIDA KEYS
Area of Critical State Concern Field Office
2796 Overseas Highway, Suite 212
Marathon, Florida 33050-2227

GREEN SWAMP
Area of Critical State Concern Field Office
155 East Summerlin
Bartow, Florida 33830-4641

SOUTH FLORIDA RECOVERY OFFICE
P.O. Box 4022
8600 N.W. 36th Street
Miami, Florida 33159-4022

UNTY: State

COMMENTS DUE WKS:
CLEARANCE DUE DATE: 12/01/97
SAI#: FL9710160748C

essage:

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Community Affairs X Environmental Protection Game and Fresh Water Fish Comm OTTED State Transportation	South Florida WMD Southwest Florida WMD St. Johns River WMD	Environmental Policy/C & ED

RECEIVED
DEC 15 1997
State of Florida Clearinghouse

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evalutation and is categorized as one of the following:

___ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.

_X_ Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.

___ Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.

___ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

Project Description:

NASA - Scoping Letter - Proposed Launch of the Space Infrared Telescope Facility (SIRTF) Observatory - Florida.

To: Florida State Clearinghouse
Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100
(850) 922-5438 (SC 292-5438)
(904) 414-0479 (FAX)

EO. 12372/NEPA

- [x] No Comment
- [ ] Comments Attached
- [ ] Not Applicable

Federal Consistency

- [x] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: FDEP / Eco. mgmt / OIP
Reviewer: April D. Wellford
Date: 11/12/97

COUNTY: State

DATE:	10/16/97
COMMENTS DUE-2 WKS:	10/31/97
CLEARANCE DUE DATE:	12/01/97
SAI#:	FL9710160748C

Message:

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Community Affairs Environmental Protection Game and Fresh Water Fish Comm X OTTED State Transportation	South Florida WMD Southwest Florida WMD St. Johns River WMD	Environmental Policy/C & ED RECEIVED OCT 29 1997 State of Florida Clearinghouse

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_X_ **Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.**

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Project Description:

NASA - Scoping Letter - Proposed Launch of the Space Infrared Telescope Facility (SIRTF) Observatory - Florida.

To: Florida State Clearinghouse
Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100
(850) 922-5438 (SC 292-5438)
(904) 414-0479 (FAX)

EO. 12372/NEPA

- ☐ No Comment
- ☐ Comments Attached
- ☐ Not Applicable

Federal Consistency

- ☒ No Comment/Consistent
- ☐ Consistent/Comments Attached
- ☐ Inconsistent/Comments Attached
- ☐ Not Applicable

From:

Division/Bureau: EOG / OTTED

Reviewer: Debra Ann Cockhill

Date: 10-27-97

COUNTY: State

Message:

DATE: 10/16/97
COMMENTS DUE-2 WKS: 10/31/97
CLEARANCE DUE DATE: 12/01/97
SAI#: FL9710160748

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Community Affairs Environmental Protection Game and Fresh Water Fish Comm OTTED State X Transportation	South Florida WMD Southwest Florida WMD St. Johns River WMD	Environmental Policy/C & ED RECEIVED OCT 29 1997 RECEIVED OCT 28 1997 State of Florida Clearinghouse State of Florida Clearinghouse

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_X_ Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.

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Project Description:

NASA - Scoping Letter - Proposed Launch of the Space Infrared Telescope Facility (SIRTF) Observatory - Florida.

To: **Florida State Clearinghouse**
Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100
(850) 922-5438 (SC 292-5438)
(904) 414-0479 (FAX)

EO. 12372/NEPA

- [x] No Comment
- [ ] Comments Attached
- [ ] Not Applicable

Federal Consistency

- [ ] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: Florida Dept. of Transportation / Aviation Office
Reviewer: William J. Ashbaker
Date: 10/27/97

COUNTY: State

Message:

DATE:	10/16/97
COMMENTS DUE-2 WKS:	10/31/97
CLEARANCE DUE DATE:	12/01/97
SAI#:	FL9710160748

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Community Affairs Environmental Protection Game and Fresh Water Fish Comm OTTED State Transportation	South Florida WMD Southwest Florida WMD X St. Johns River WMD RECEIVED OCT 27 1997 State of Florida Clearinghouse	Environmental Policy/C & ED ST. JOHNS RIVER WATER MGT. DISTRICT OCT 20 1997

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evalutation and is categorized as one of the following:

___ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.

_X_ Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.

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Project Description:

NASA - Scoping Letter - Proposed Launch of the Space Infrared Telescope Facility (SIRTF) Observatory - Florida.

To: Florida State Clearinghouse
Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100
(850) 922-5438 (SC 292-5438)
(904) 414-0479 (FAX)

EO. 12372/NEPA

- ☐ No Comment
- ☐ Comments Attached
- ☐ Not Applicable

Federal Consistency

- ☒ No Comment/Consistent
- ☐ Consistent/Comments Attached
- ☐ Inconsistent/Comments Attached
- ☐ Not Applicable

From:

Division/Bureau: Policy & Planning

Reviewer: Margaret H. Spontak

Date: October 23, 1997

South
Florida
Regional
Planning
Council

November 12, 1997

Ms. Keri Akers
Florida State Clearinghouse
Dept. of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100

RE: SFRPC #97-1035, SAI #FL9710160748C, Request for comments on the proposed launch of the Space Infrared Telescope Facility Observatory.

Dear Ms. Akers:

We have reviewed the above-referenced application and have the following comments:

- The plan, as proposed, is generally consistent with the goals and policies of the *Strategic Regional Policy Plan for South Florida*, specifically the following:

<u>Promote the elimination of avoidable impacts to Natural Resources of Regional Significance and other high quality natural systems</u>

3.1.9 Degradation or destruction of Natural Resources of Regional Significance, including listed species and their habitats will occur as a result of a proposed project only if :

a) the activity is necessary to prevent or eliminate a public hazard, and
b) the activity is in the public interest and no other alternative exists, and
c) the activity does not destroy significant natural habitat, or identified natural resource values, and
d) the activity does not destroy habitat for threatened or endangered species, and
e) the activity does not negatively impact listed species that have been documented to use or rely upon the site.

Thank you for the opportunity to comment. We would appreciate being kept informed on the progress of this project. Please call if you have any questions.

Sincerely,

Doris A. Mitchell

Doris A. Mitchell
Senior Planner

cc: Dr. Johnny Kwok, Jet Propulsion Laboratory

DAM/kc

3440 Hollywood Boulevard, Suite 140, Hollywood, Florida 33021
Broward (954) 985-4416, Area Codes 305, 407 and 561 (800) 985-4416
SunCom 473-4416, FAX (954) 985-4417, SunCom FAX 473-4417
e-mail sfadmin@sfrpc.com

Southwest Florida Regional Planning Council

4980 Bayline Drive, 4th Floor, N. Ft. Myers, FL 33917-3909 (941) 656-7720

P.O. Box 3455, N. Ft. Myers, FL 33918-3455 SUNCOM 749-7720
FAX 941-656-7724

October 27, 1997

Dr. Johnny Kwok
Jet Propulsion Laboratory
4800 Oak Grove Drive
Mail Stop 126-304
PASADENA, CA 91109

RE: IC&R Project #97-381
State Clearinghouse #FL9710160748C

NASA - Scoping Letter - Proposed Launch of the Space Infrared Telescope Facility (SIRTF) Observatory - Florida.

Dear Dr. Kwok:

The staff of the Southwest Florida Regional Planning Council reviews various proposals, Notifications of Intent, Preapplications, permit applications, and Environmental Impact Statements for compliance with regional goals, objectives, and policies, as determined by the Strategic Regional Policy Plan. The staff reviews such items in accordance with the Florida Intergovernmental Coordination and Review Process (Chapter 29I-5, F.A.C.), and adopted regional clearinghouse procedures.

These designations determine Council staff procedure in regards to the reviewed project. The four designations are:

Less Than Regionally Significant and Consistent no further review of the project can be expected from Council.

Less Than Regionally Significant and Inconsistent Council does not find the project of regional importance, but will note certain concerns as part of its continued monitoring for cumulative impact within the noted goal area.

Regionally Significant and Consistent project is of regional importance, and appears to be consistent with Regional goals, objectives, and policies.

Regionally Significant and Inconsistent project is of regional importance and does not appear to be consistent with Regional goals, objectives, and policies. Council will oppose the project as submitted, but is willing to participate in any efforts to modify the project to mitigate the concerns.

338/97

FLORIDA STATE CLEARINGHOUSE RPC INTERGOVERNMENTAL COORDINATION AND RESPONSE SHEET

Local

SAI #: FL9710160748C

DATE: 10/16/97

COMMENTS DUE TO CLEARINGHOUSE: 11/15/97

AREA OF PROPOSED ACTIVITY: COUNTY: State

☐ FEDERAL ASSISTANCE ☒ DIRECT FEDERAL ACTIVITY ☐ FEDERAL LICENSE OR PERMIT ☐ OCS

PROJECT DESCRIPTION

NASA - Scoping Letter - Proposed Launch of the Space Infrared Telescope Facility (SIRTF) Observatory - Florida.

ROUTING:

RPC

South FL RPC
SW Florida RPC
X Tampa Bay RPC
Treasure Coast RPC
Central FL RPC
E Central FL RPC
Withlacoochee RPC

RECEIVED
NOV 19 1997
State of Florida Clearinghouse

PLEASE CHECK ALL THE LOCAL GOVERNMENTS BELOW FROM WHICH COMMENTS HAVE BEEN RECEIVED; ALL COMMENTS RECEIVED SHOULD BE INCLUDED IN THE RPC'S CLEARINGHOUSE RESPONSE PACKAGE. IF NO COMMENTS WERE RECEIVED, PLEASE CHECK "NO COMMENT" BOX AND RETURN TO CLEARINGHOUSE.

COMMENTS DUE TO RPC: 11/06/97

NO COMMENTS: ✓

(IF THE RPC DOES NOT RECEIVE COMMENTS BY THE DEADLINE DATE, THE RPC SHOULD CONTACT THE LOCAL GOVERNMENT TO DETERMINE THE STATUS OF THE PROJECT REVIEW PRIOR TO FORWARDING THE RESPONSE PACKAGE TO THE CLEARINGHOUSE.)

NOTES:

ALL CONCERNS OR COMMENTS REGARDING THE ATTACHED PROJECT (INCLUDING ANY RPC COMMENTS) SHOULD BE SENT IN WRITING BY THE DUE DATE TO THE CLEARINGHOUSE. PLEASE ATTACH THIS RESPONSE FORM AND REFER TO THE SAI # IN ALL CORESPONDENCE.

IF YOU HAVE ANY QUESTIONS REGARDING THE ATTACHED PROJECT, PLEASE CONTACT THE STATE CLEARINGHOUSE AT (904) 922-5438 OR SUNCOM 272-5438.

FLORIDA STATE CLEARINGHOUSE
RPC INTERGOVERNMENTAL COORDINATION
AND RESPONSE SHEET

SAI #: FL9710160748C **DATE:** 10/16/97

COMMENTS DUE TO CLEARINGHOUSE: 11/15/97

AREA OF PROPOSED ACTIVITY: COUNTY: State

☐ FEDERAL ASSISTANCE ☒ DIRECT FEDERAL ACTIVITY ☐ FEDERAL LICENSE OR PERMIT ☐ OCS

PROJECT DESCRIPTION

NASA - Scoping Letter - Proposed Launch of the Space Infrared Telescope Facility (SIRTF) Observatory - Florida.

ROUTING: **RPC**

South FL RPC
SW Florida RPC
Tampa Bay RPC
X Treasure Coast RPC
Central FL RPC
E Central FL RPC
Withlacoochee RPC

RECEIVED
OCT 21 1997
TREASURE COAST REGIONAL PLANNING COUNCIL

PLEASE CHECK ALL THE LOCAL GOVERNMENTS BELOW FROM WHICH COMMENTS HAVE BEEN RECEIVED; ALL COMMENTS RECEIVED SHOULD BE INCLUDED IN THE RPC'S CLEARINGHOUSE RESPONSE PACKAGE. IF NO COMMENTS WERE RECEIVED, PLEASE CHECK "NO COMMENT" BOX AND RETURN TO CLEARINGHOUSE.

COMMENTS DUE TO RPC: 11/06/97

NO COMMENTS: ____

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IF YOU HAVE ANY QUESTIONS REGARDING THE ATTACHED PROJECT, PLEASE CONTACT THE STATE CLEARINGHOUSE AT (904) 922-5438 OR SUNCOM 272-5438.

GROWING SMARTER THROUGH REGIONAL PLANNING ■ TOGETHER WE CAN

East Central Florida
REGIONAL PLANNING COUNCIL

1011 Wymore Road
Suite 105
Winter Park, Florida
32789-1797

Phone 407 . 623 . 1075
Fax 407 . 623 . 1084

Suncom 334 . 1075
Suncom Fax 334 . 1084

October 21, 1997

RECEIVED
OCT 27 1997
State of Florida Clearinghouse

Ms. Keri Akers
Florida State Clearinghouse
Department of Community Affairs
2555 Shumard Oak Blvd.
Tallahassee, FL 32399-2100

RE: NASA
ECFRPC # RE-98-04
SAI #: FL9710160748C

Dear Keri:

In accordance with the Office of Planning and Budgeting Intergovernmental Coordination and Review Process, this office has conducted a clearinghouse review of the above referenced proposal.

Based on this review, the Council offers the following comments and/or recommendations:

> The proposed project, as presented for review and when considered in its entirety, is consistent with the adopted Goals, Policies and Objectives of the East Central Florida Regional Planning Council.

Should there be any questions concerning this review, please contact the Project Review Division at the Council Office.

Sincerely,

T. Hunalp

Teri Bryant-Hunalp
Technical Assistant
Planning Services

FLC IDA STATE CLEARINGE USE
RPC INTERGOVERNMENTAL COORDINATION AND RESPONSE SHEET

SAI #: FL9710160748C RECEIVED 1997 DATE: 10/16/97

COMMENTS DUE TO CLEARINGHOUSE: 11/15/97

AREA OF PROPOSED ACTIVITY: COUNTY: State

☐ FEDERAL ASSISTANCE ☒ DIRECT FEDERAL ACTIVITY ☐ FEDERAL LICENSE OR PERMIT ☐ OCS

PROJECT DESCRIPTION

NASA - Scoping Letter - Proposed Launch of the Space Infrared Telescope Facility (SIRTF) Observatory - Florida.

RECEIVED NOV 10 1997 State of Florida Clearinghouse

ROUTING:

RPC

- South FL RPC
- SW Florida RPC
- Tampa Bay RPC
- Treasure Coast RPC
- Central FL RPC
- E Central FL RPC
- X Withlacoochee RPC -# 66-F20-97-NASA

PLEASE CHECK ALL THE LOCAL GOVERNMENTS BELOW FROM WHICH COMMENTS HAVE BEEN RECEIVED; ALL COMMENTS RECEIVED SHOULD BE INCLUDED IN THE RPC'S CLEARINGHOUSE RESPONSE PACKAGE. IF NO COMMENTS WERE RECEIVED, PLEASE CHECK "NO COMMENT" BOX AND RETURN TO CLEARINGHOUSE.

COMMENTS DUE TO RPC: 11/06/97

NO COMMENTS: ____

(IF THE RPC DOES NOT RECEIVE COMMENTS BY THE DEADLINE DATE, THE RPC SHOULD CONTACT THE LOCAL GOVERNMENT TO DETERMINE THE STATUS OF THE PROJECT REVIEW PRIOR TO FORWARDING THE RESPONSE PACKAGE TO THE CLEARINGHOUSE.)

NOTES: 11/7/97: The WRPC has no comments at this time, but requests a copy of the EIS when it becomes available.

ALL CONCERNS OR COMMENTS REGARDING THE ATTACHED PROJECT (INCLUDING ANY RPC COMMENTS) SHOULD BE SENT IN WRITING BY THE DUE DATE TO THE CLEARINGHOUSE. PLEASE ATTACH THIS RESPONSE FORM AND REFER TO THE SAI # IN ALL CORESPONDENCE.

IF YOU HAVE ANY QUESTIONS REGARDING THE ATTACHED PROJECT, PLEASE CONTACT THE STATE CLEARINGHOUSE AT (904) 922-5438 OR SUNCOM 272-5438.

Appendix B

Selected REEDM Output for a Delta II 7920H:

Normal Launch Mode

Conflagration Mode Failure

Deflagration Mode Failure

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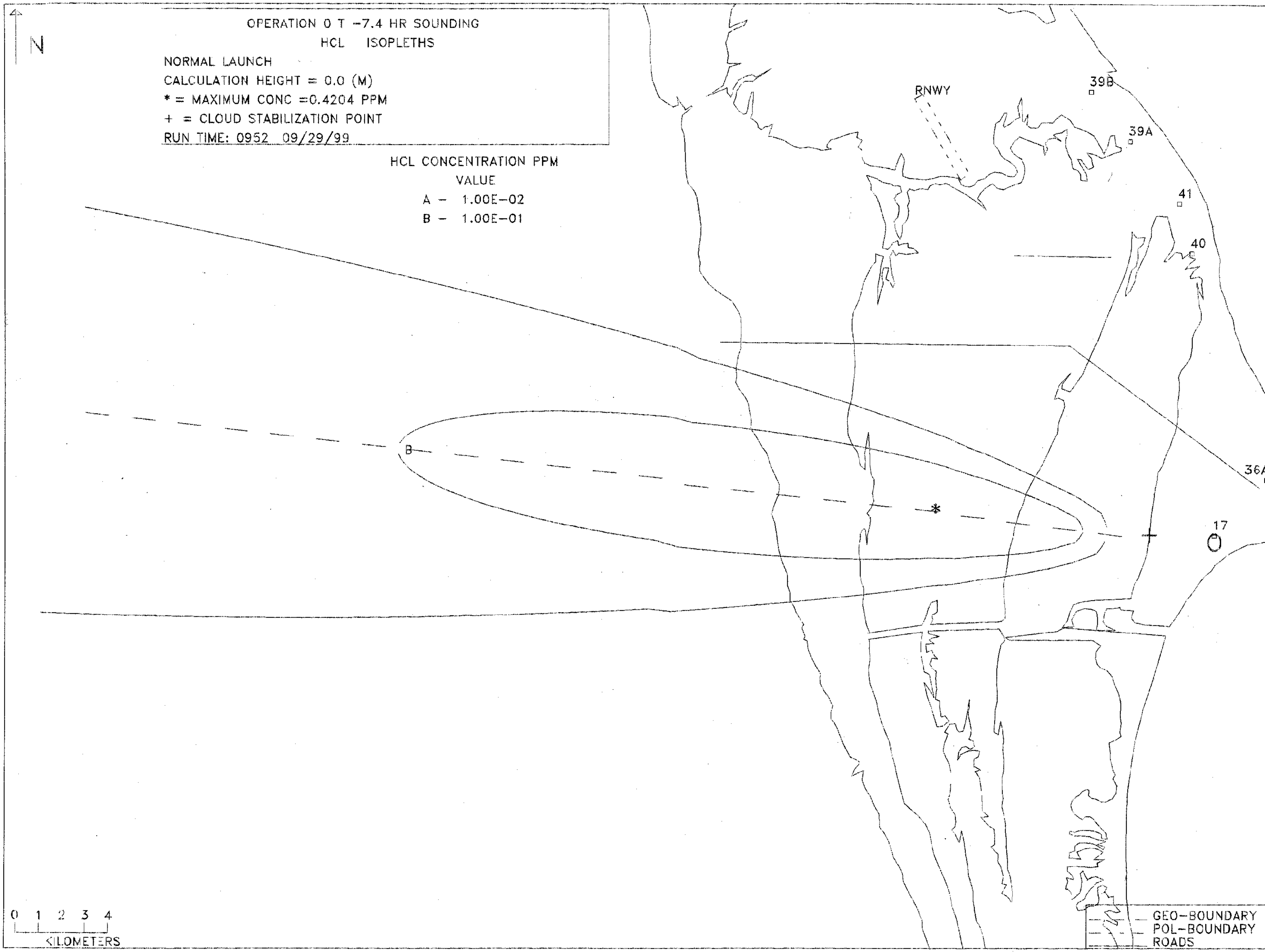
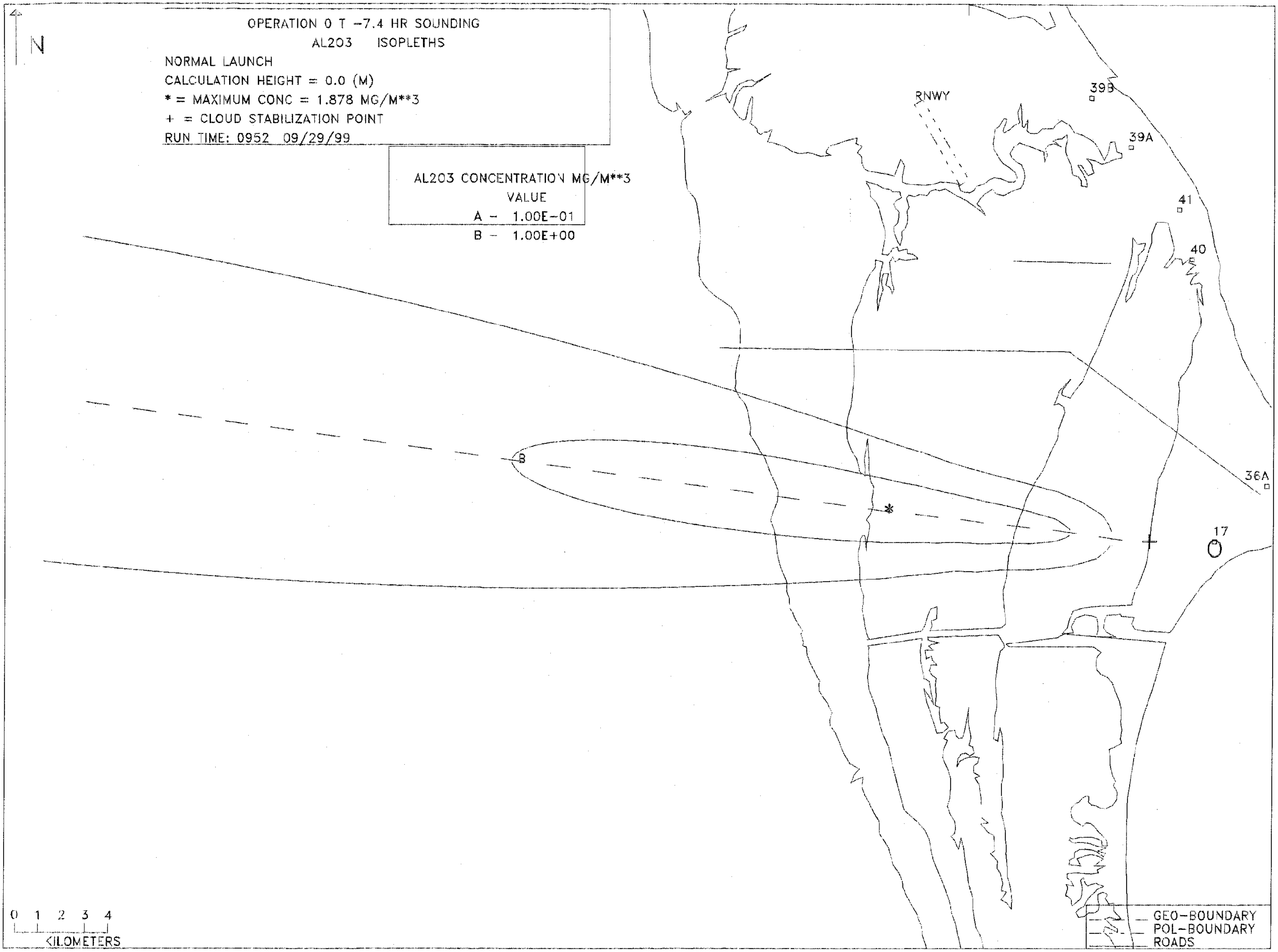


OPERATION 0 T -7.4 HR SOUNDING
HCL ISOPLETHS
NORMAL LAUNCH
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC =0.4204 PPM
+ = CLOUD STABILIZATION POINT
RUN TIME: 0952 09/29/99
HCL CONCENTRATION PPM
VALUE
A - 1.00E-02
B - 1.00E-01
N
B
RNWY
39B
39A
41
40
36A
17
0 1 2 3 4
KILOMETERS
GEO-BOUNDARY
POL-BOUNDARY
ROADS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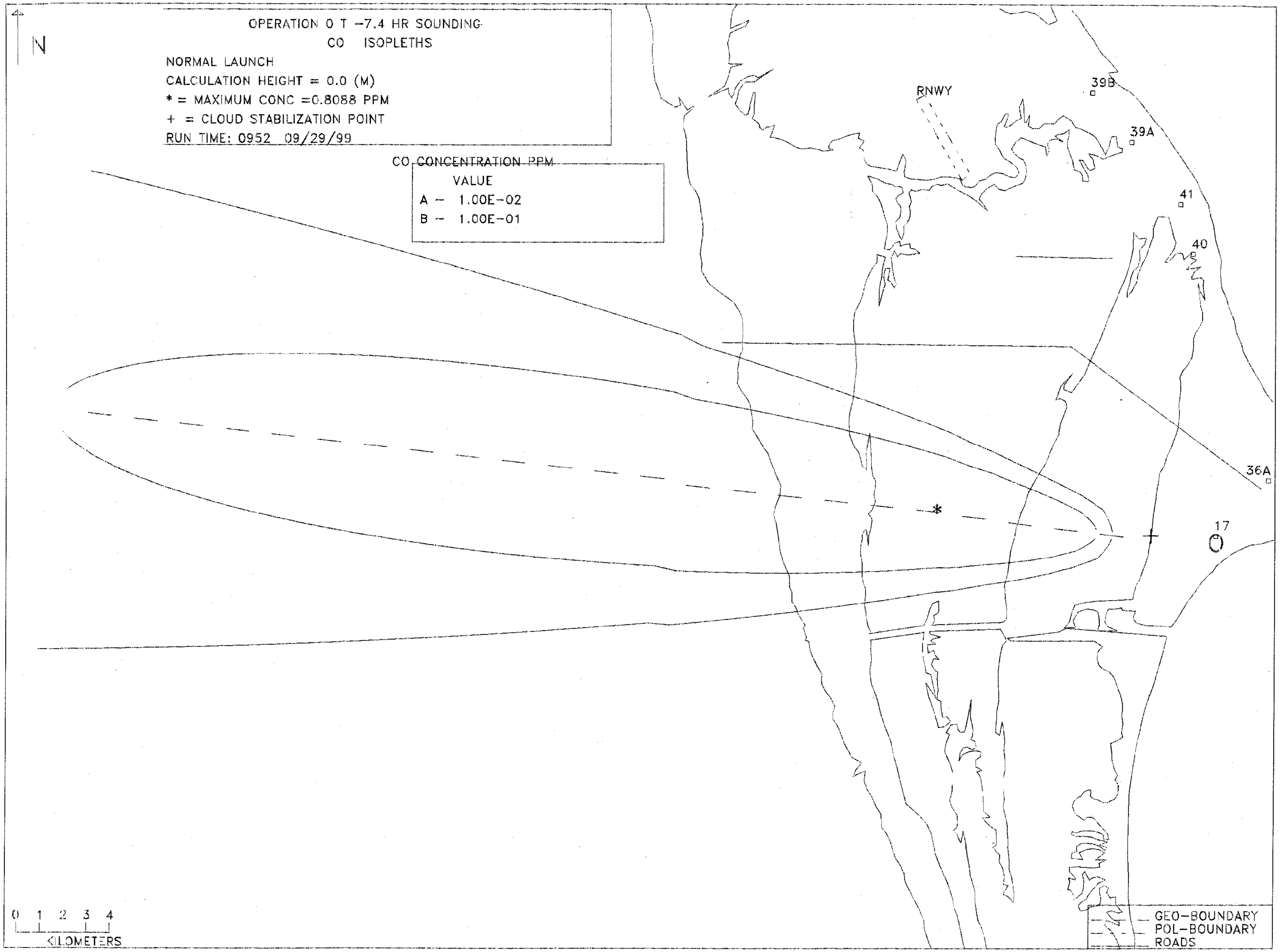
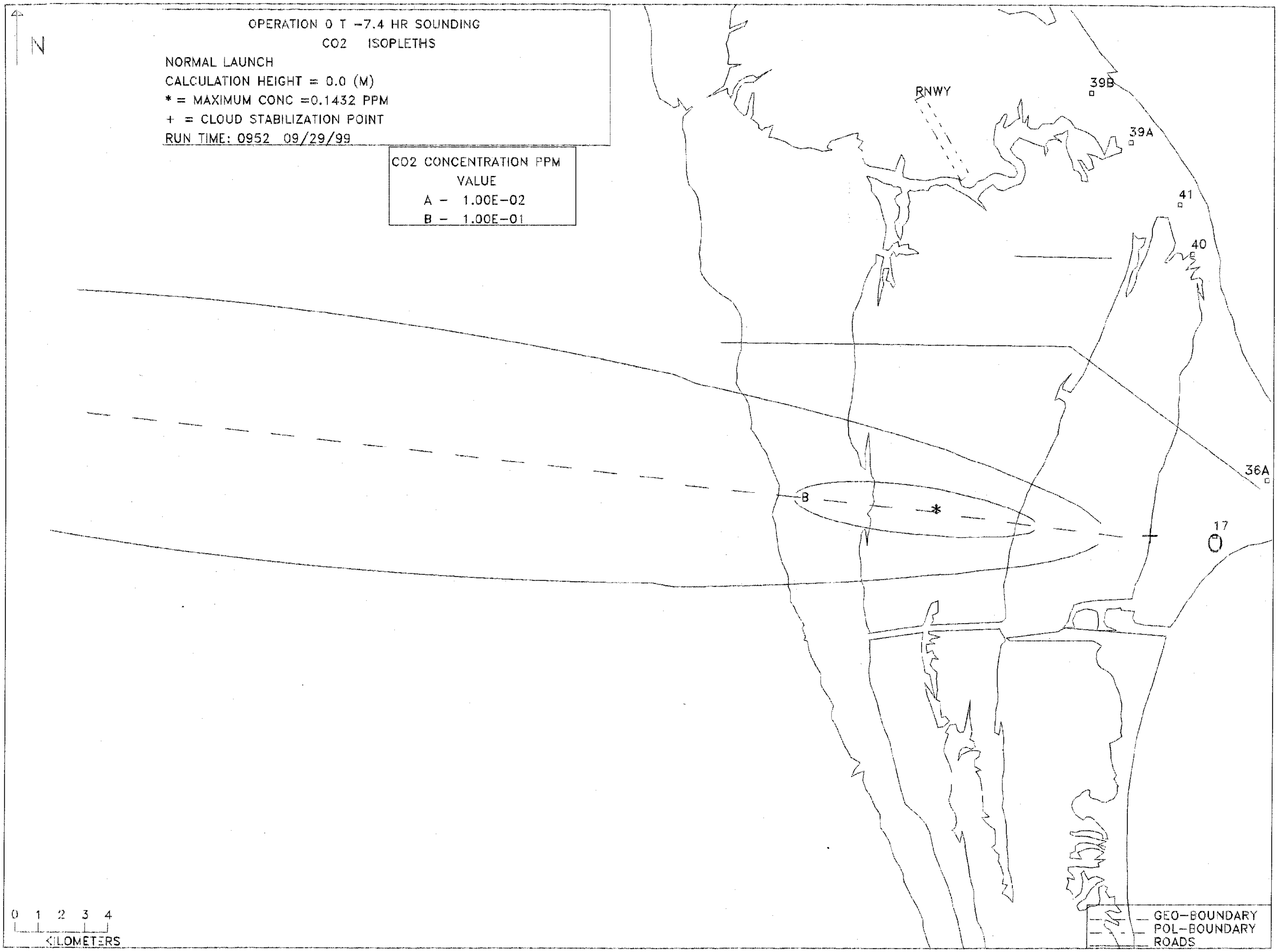
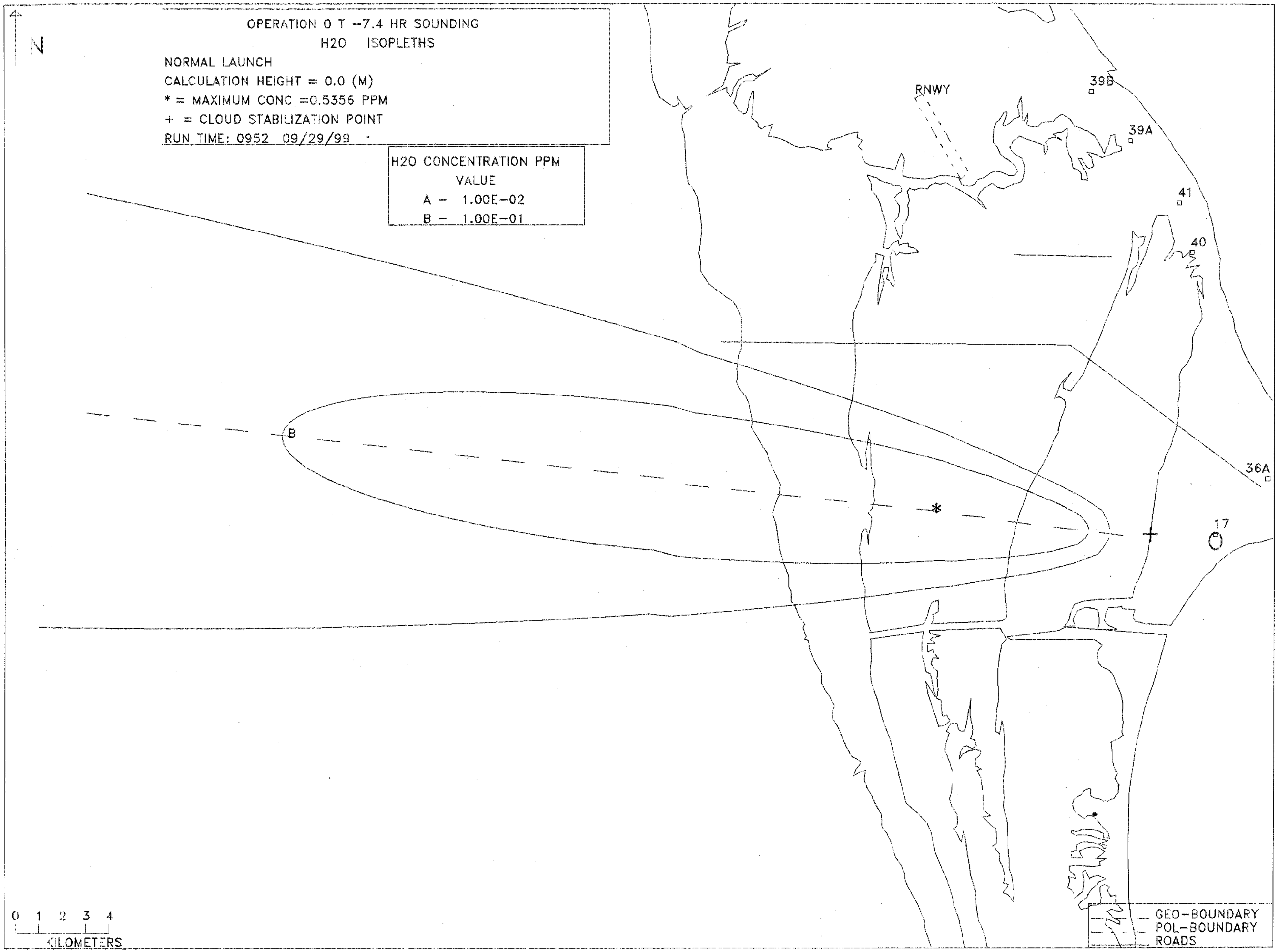
AL203 ISOPLETHS
NORMAL LAUNCH
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC = 1.878 MG/M**3
+ = CLOUD STABILIZATION POINT
RUN TIME: 0952 09/29/99
AL203 CONCENTRATION MG/M**3
VALUE
A - 1.00E-01
B - 1.00E+00
N
RNWY
39B
39A
41
40
36A
17
B
0 1 2 3 4
KILOMETERS
GEO-BOUNDARY
POL-BOUNDARY
ROADS



N
OPERATION 0 T -7.4 HR SOUNDING
CO ISOPLETHS
NORMAL LAUNCH
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC =0.8088 PPM
+ = CLOUD STABILIZATION POINT
RUN TIME: 0952 09/29/99
CO CONCENTRATION PPM
VALUE
A - 1.00E-02
B - 1.00E-01
RNWY
39B
39A
41
40
36A
17
0 1 2 3 4
KILOMETERS
GEO-BOUNDARY
POL-BOUNDARY
ROADS



OPERATION 0 T -7.4 HR SOUNDING
CO2 ISOPLETHS
NORMAL LAUNCH
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC =0.1432 PPM
+ = CLOUD STABILIZATION POINT
RUN TIME: 0952 09/29/99
CO2 CONCENTRATION PPM
VALUE
A - 1.00E-02
B - 1.00E-01
N
RNWY
39B
39A
41
40
36A
17
B
0 1 2 3 4
KILOMETERS
GEO-BOUNDARY
POL-BOUNDARY
ROADS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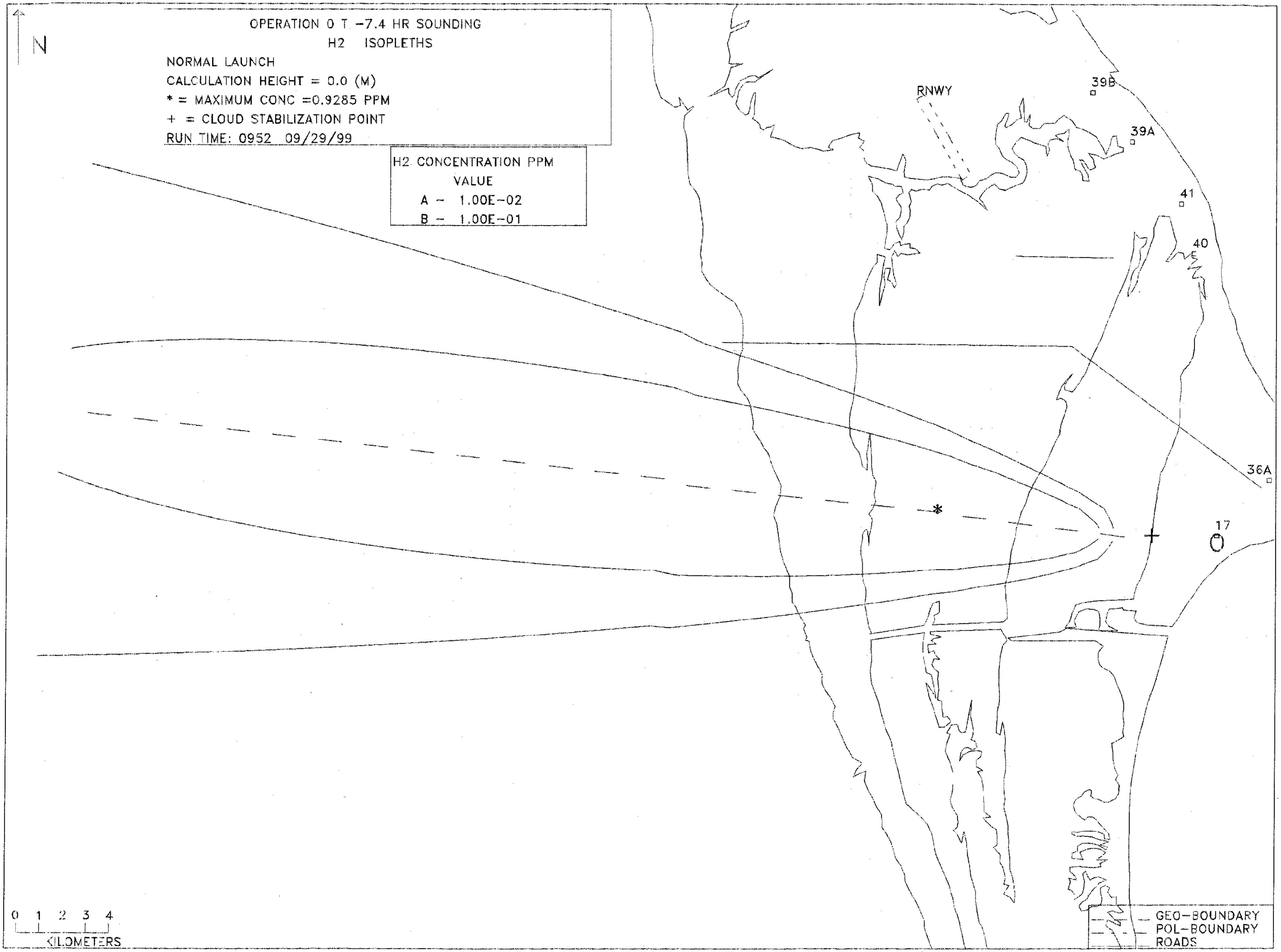
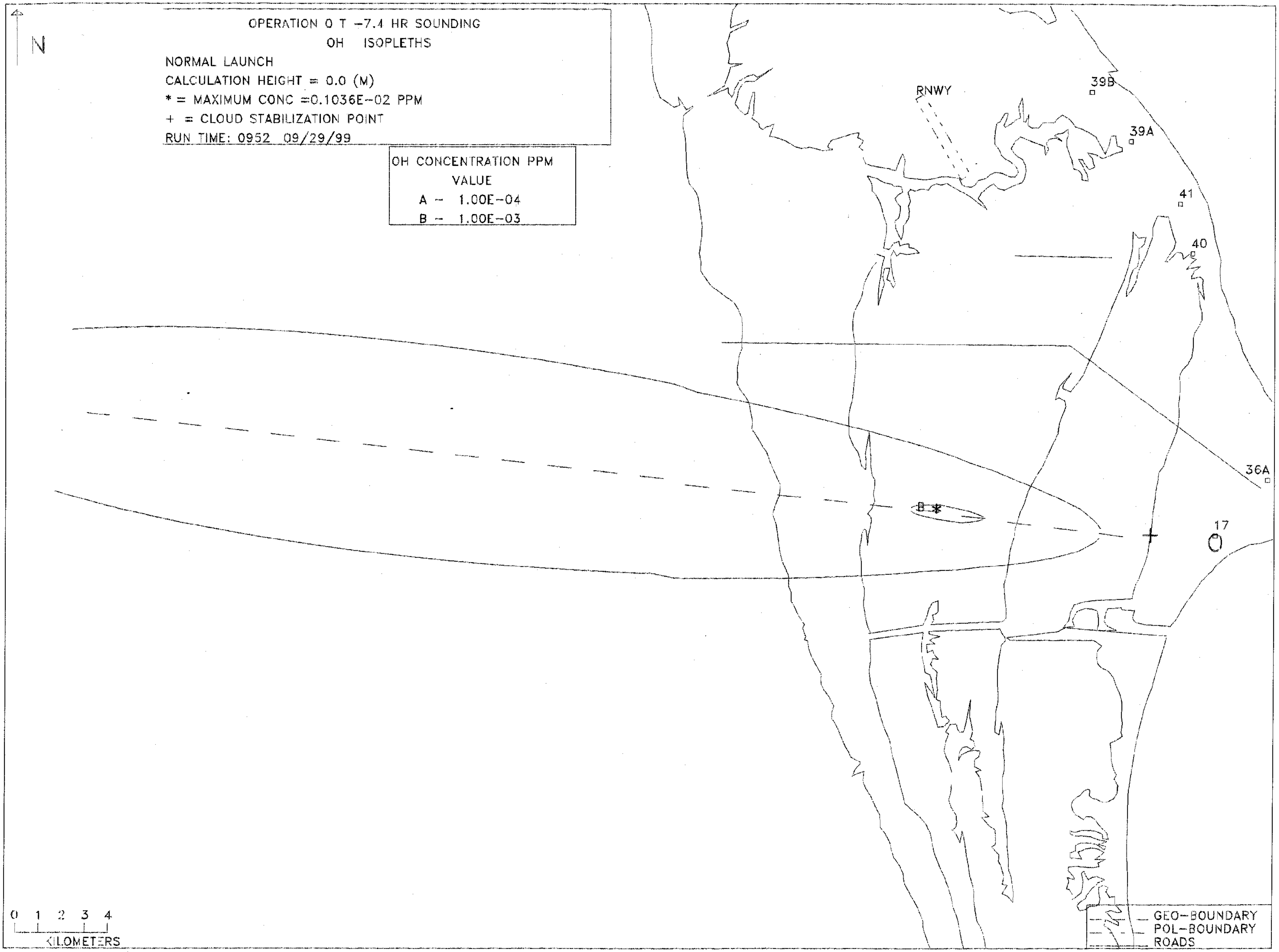
H2O ISOPLETHS
NORMAL LAUNCH
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC =0.5356 PPM
+ = CLOUD STABILIZATION POINT
RUN TIME: 0952 09/29/99
H2O CONCENTRATION PPM
VALUE
A - 1.00E-02
B - 1.00E-01
N
RNWY
39B
39A
41
40
36A
17
B
0 1 2 3 4
KILOMETERS
GEO-BOUNDARY
POL-BOUNDARY
ROADS



N
OPERATION 0 T -7.4 HR SOUNDING
H2 ISOPLETHS
NORMAL LAUNCH
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC =0.9285 PPM
+ = CLOUD STABILIZATION POINT
RUN TIME: 0952 09/29/99
H2 CONCENTRATION PPM
VALUE
A - 1.00E-02
B - 1.00E-01
RNWY
39B
39A
41
40
36A
17
0 1 2 3 4
KILOMETERS
GEO-BOUNDARY
POL-BOUNDARY
ROADS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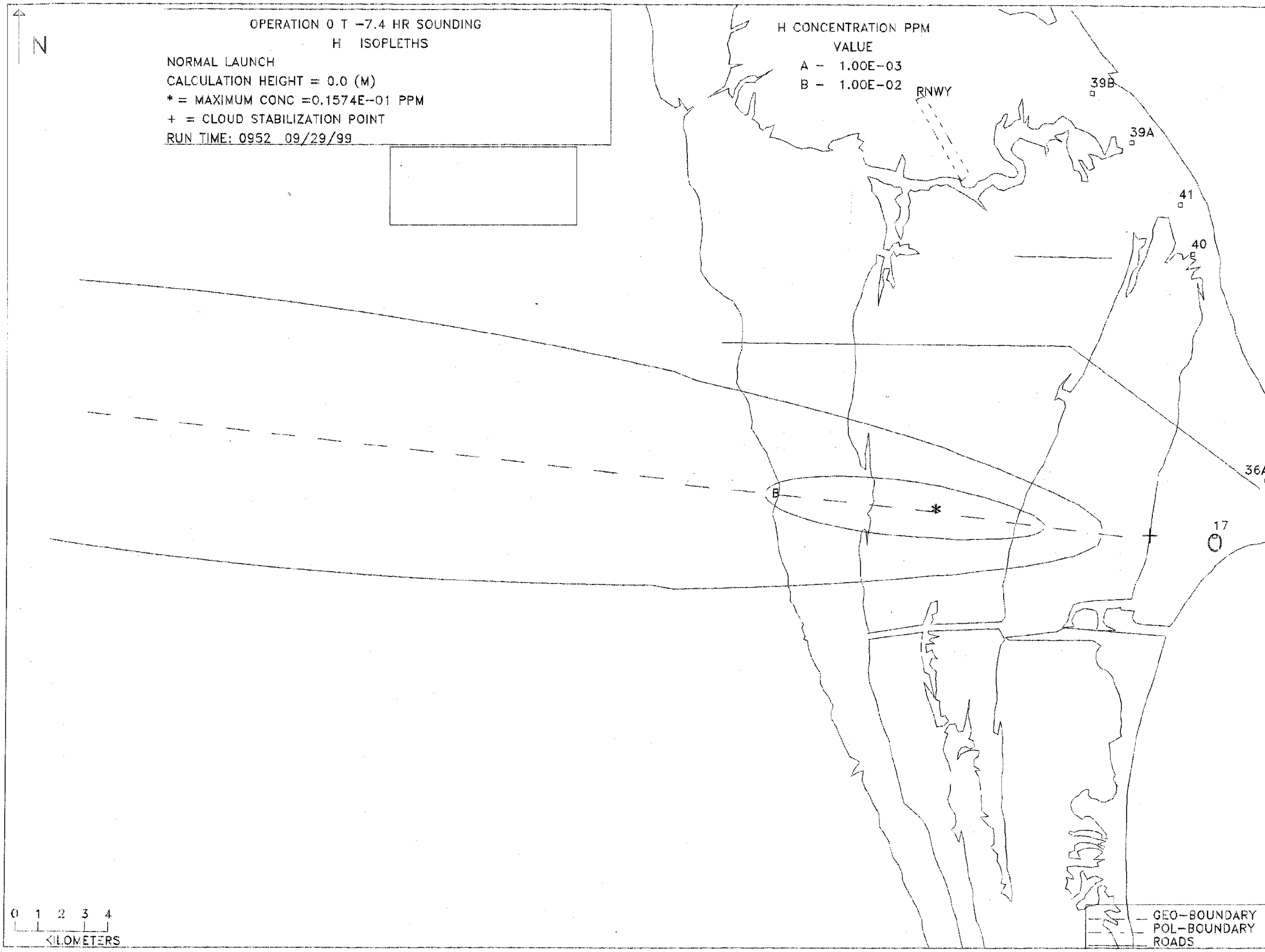
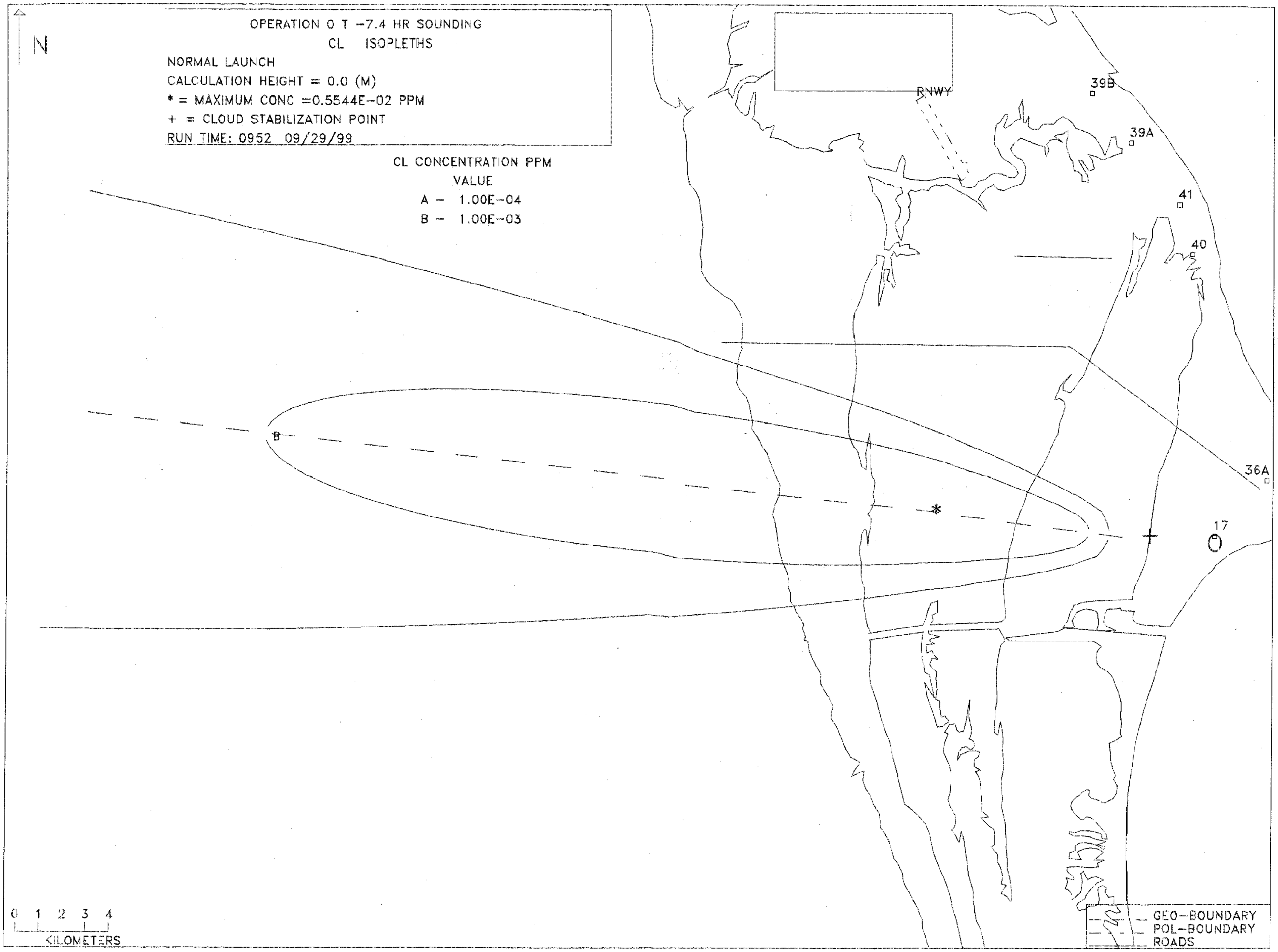
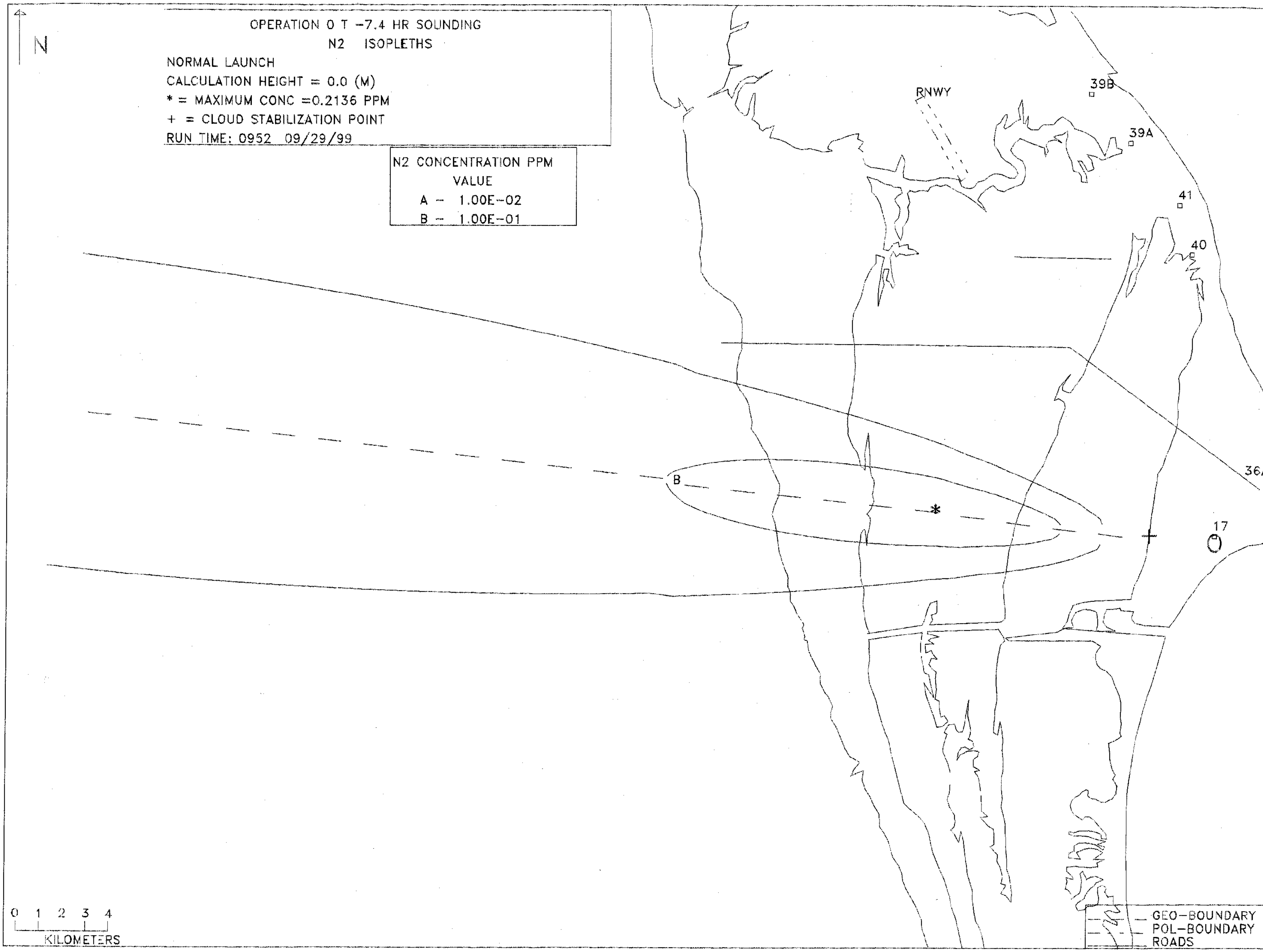
OH ISOPLETHS
NORMAL LAUNCH
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC =0.1036E-02 PPM
+ = CLOUD STABILIZATION POINT
RUN TIME: 0952 09/29/99
OH CONCENTRATION PPM
VALUE
A -- 1.00E-04
B -- 1.00E-03
N
RNWY
39B
39A
41
40
36A
17
B
0 1 2 3 4
KILOMETERS
GEO-BOUNDARY
POL-BOUNDARY
ROADS

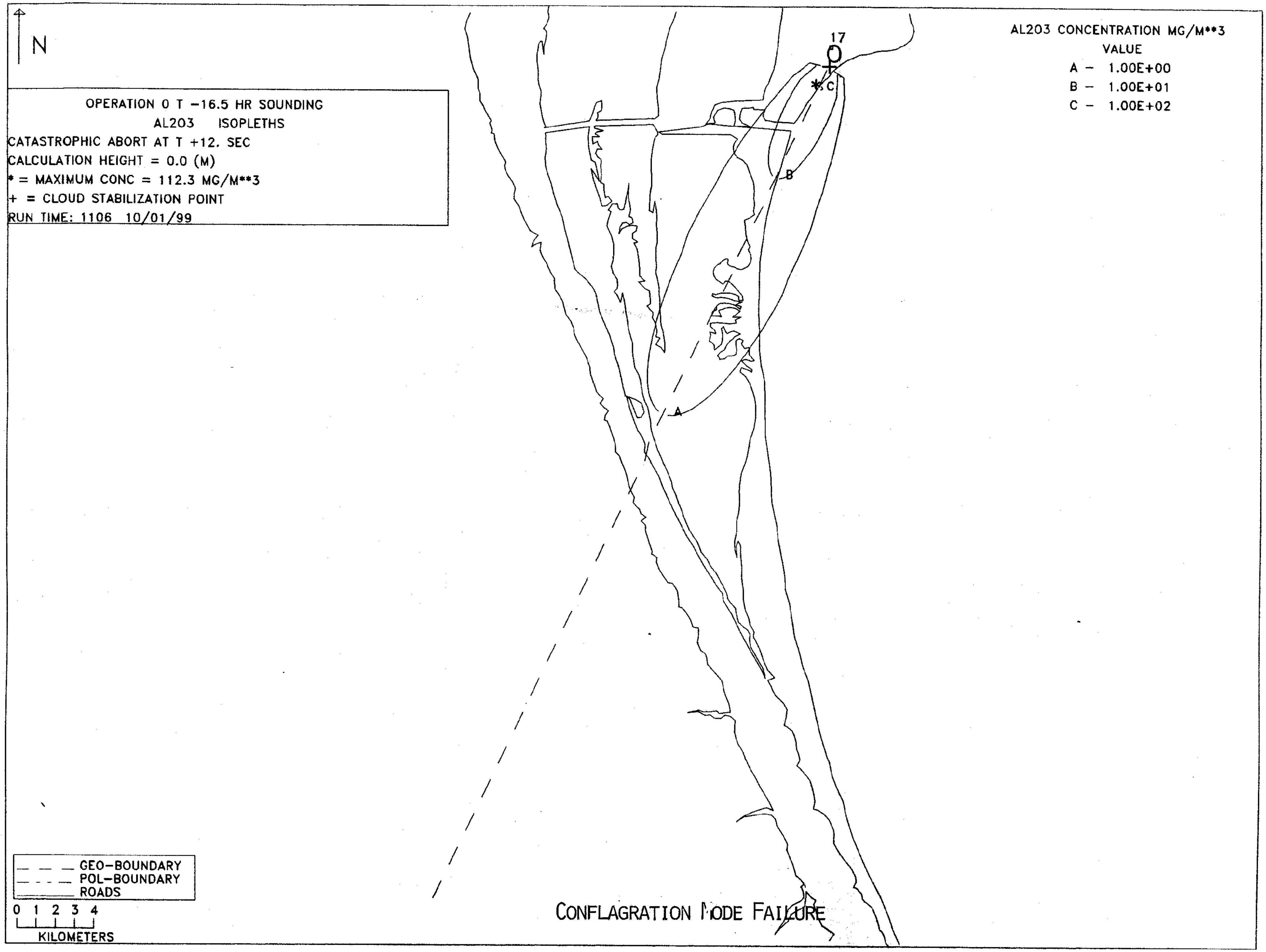


OPERATION 0 T -7.4 HR SOUNDING
H ISOPLETHS
NORMAL LAUNCH
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC =0.1574E-01 PPM
+ = CLOUD STABILIZATION POINT
RUN TIME: 0952 09/29/99
N
H CONCENTRATION PPM
VALUE
A - 1.00E-03
B - 1.00E-02
RNWY
39B
39A
41
40
36A
17
B
0 1 2 3 4
KILOMETERS
GEO-BOUNDARY
POL-BOUNDARY
ROADS

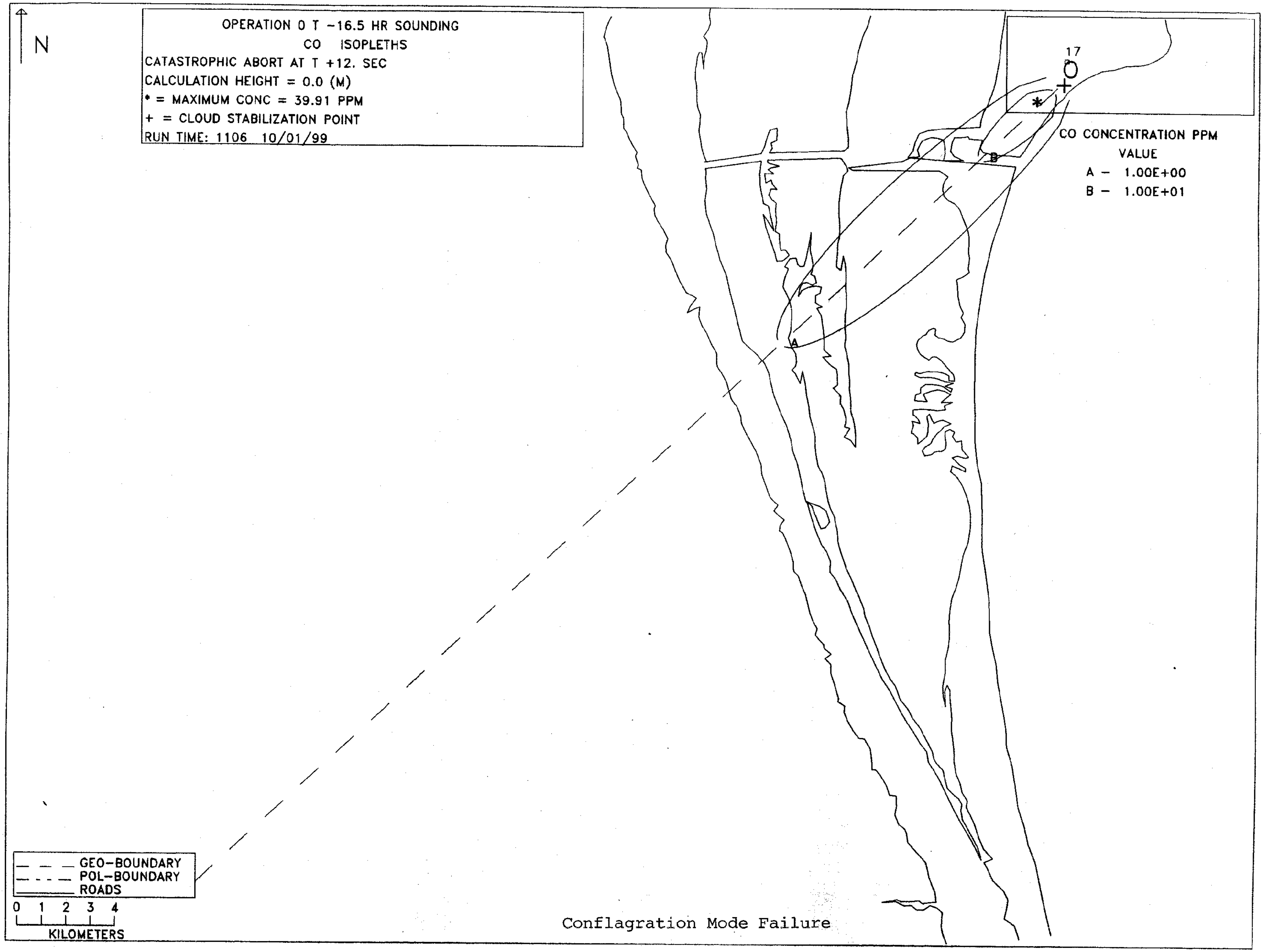


OPERATION 0 T -7.4 HR SOUNDING
CL ISOPLETHS
NORMAL LAUNCH
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC =0.5544E-02 PPM
+ = CLOUD STABILIZATION POINT
RUN TIME: 0952 09/29/99
CL CONCENTRATION PPM
VALUE
A - 1.00E-04
B - 1.00E-03
N
RNWY
39B
39A
41
40
36A
17
B
0 1 2 3 4
KILOMETERS
GEO-BOUNDARY
POL-BOUNDARY
ROADS

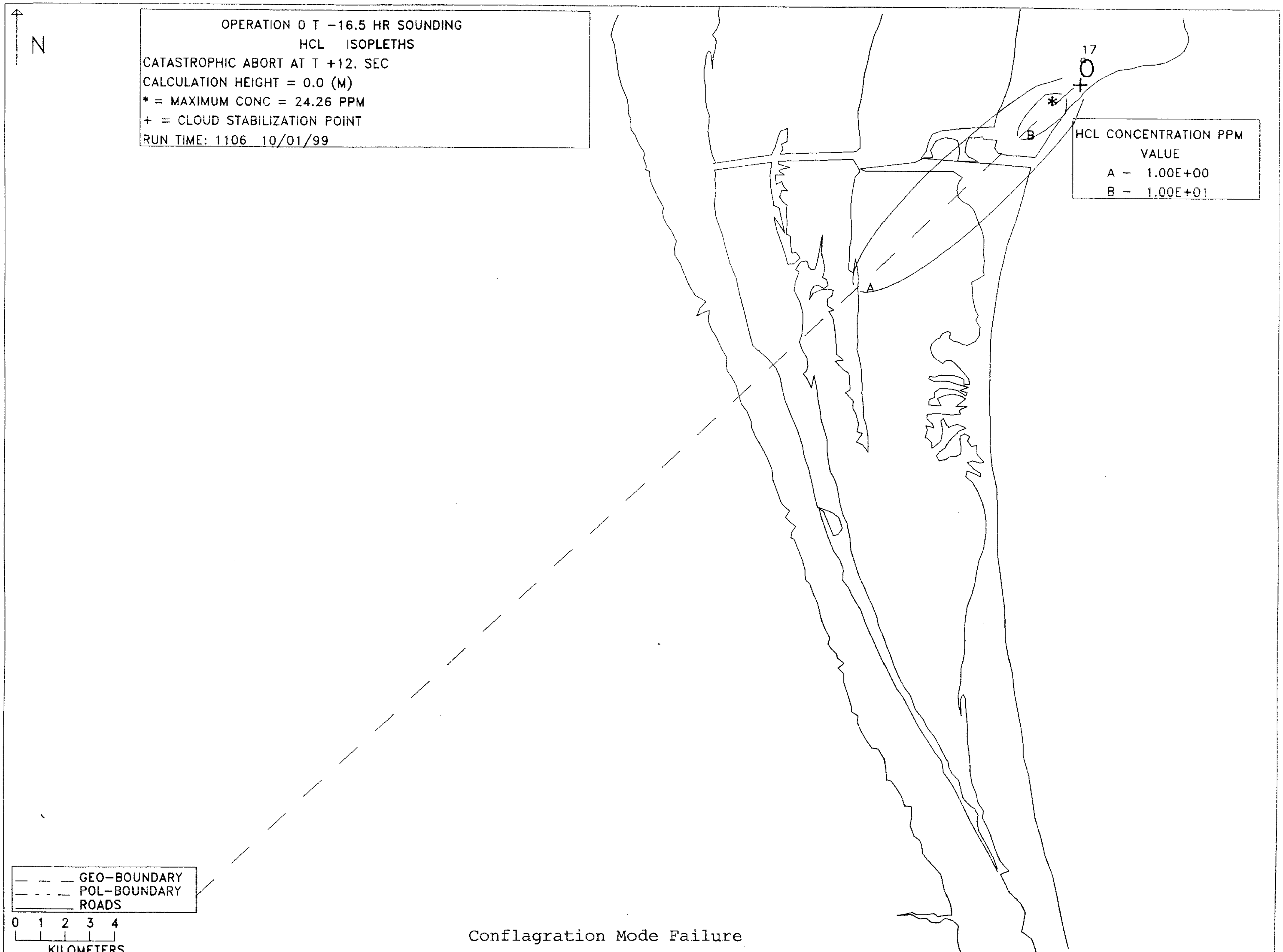

N
OPERATION 0 T -7.4 HR SOUNDING
N2 ISOPLETHS
NORMAL LAUNCH
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC =0.2136 PPM
+ = CLOUD STABILIZATION POINT
RUN TIME: 0952 09/29/99
N2 CONCENTRATION PPM
VALUE
A -- 1.00E-02
B -- 1.00E-01
RNWY
39B
39A
41
40
36A
17
B
0 1 2 3 4
KILOMETERS
GEO-BOUNDARY
POL-BOUNDARY
ROADS



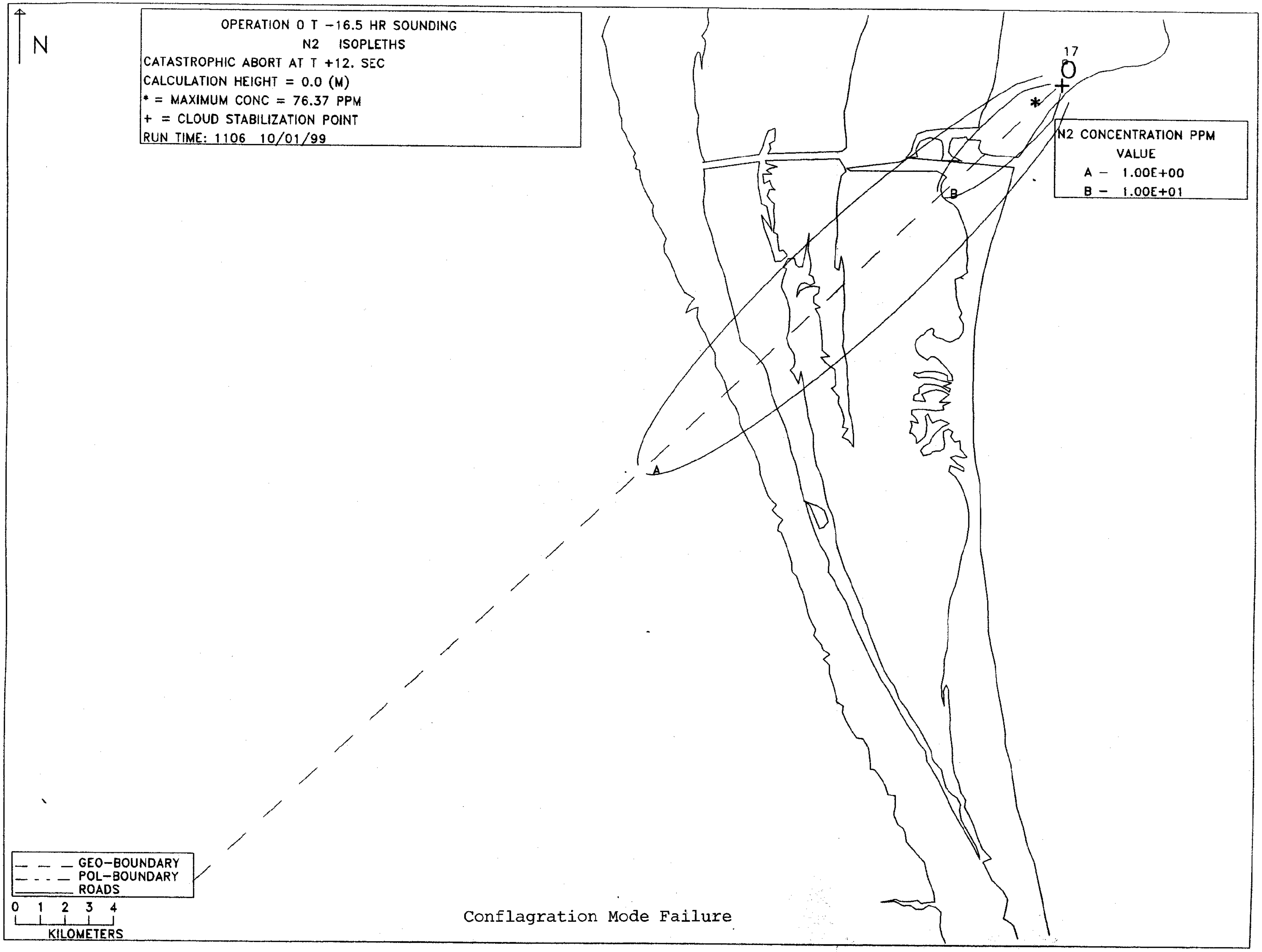
CONFLAGRATION MODE FAILURE



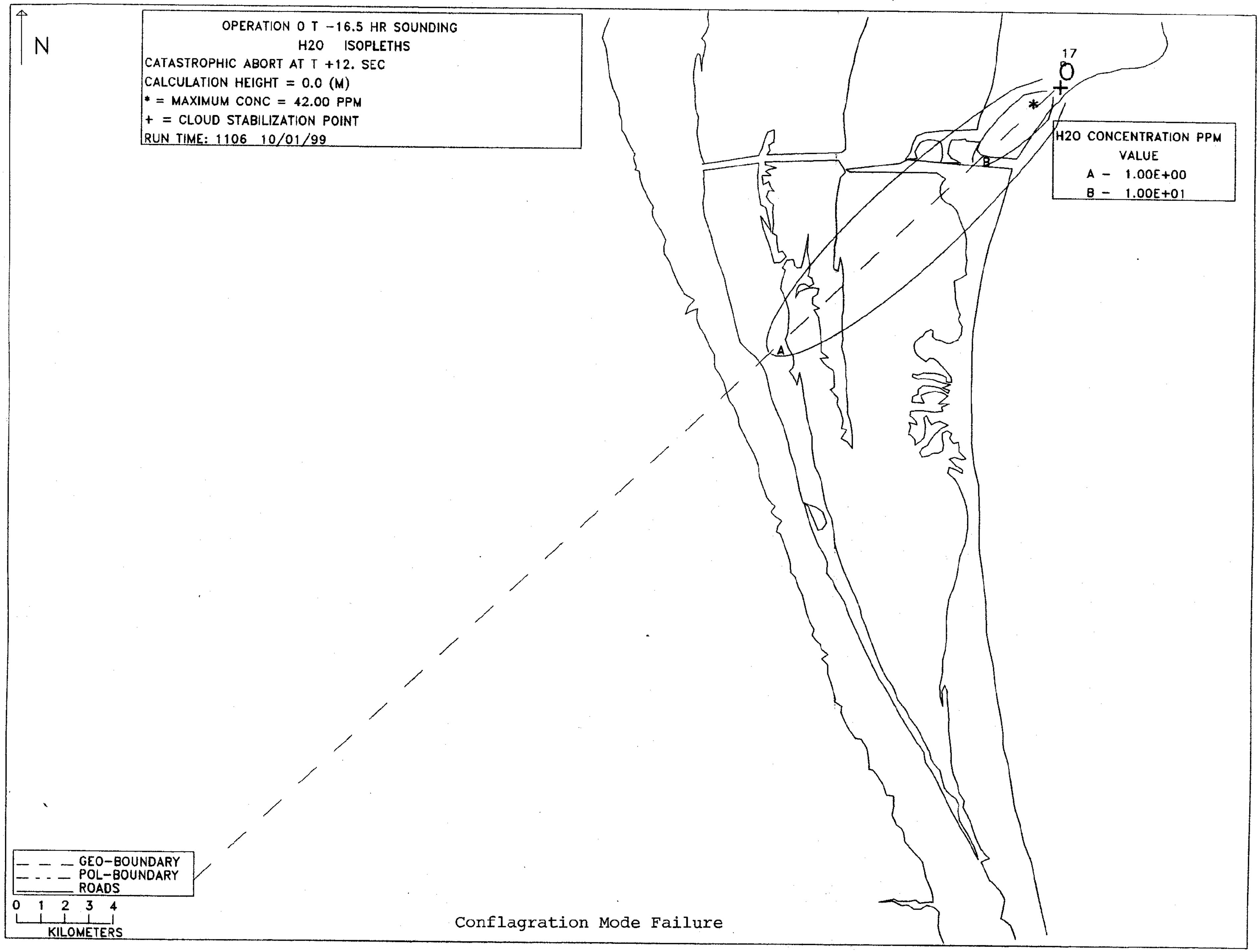
Conflagration Mode Failure



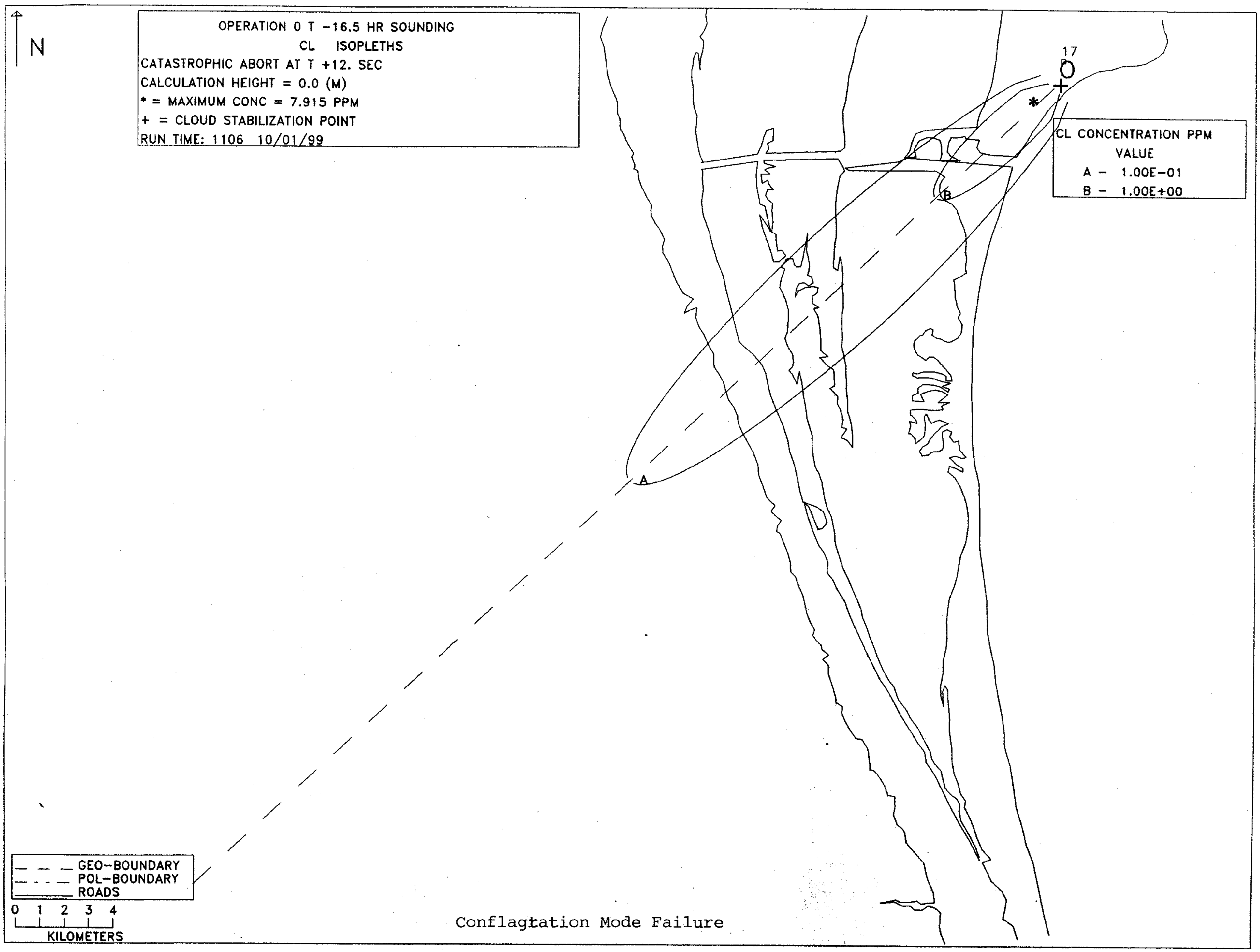
Conflagration Mode Failure



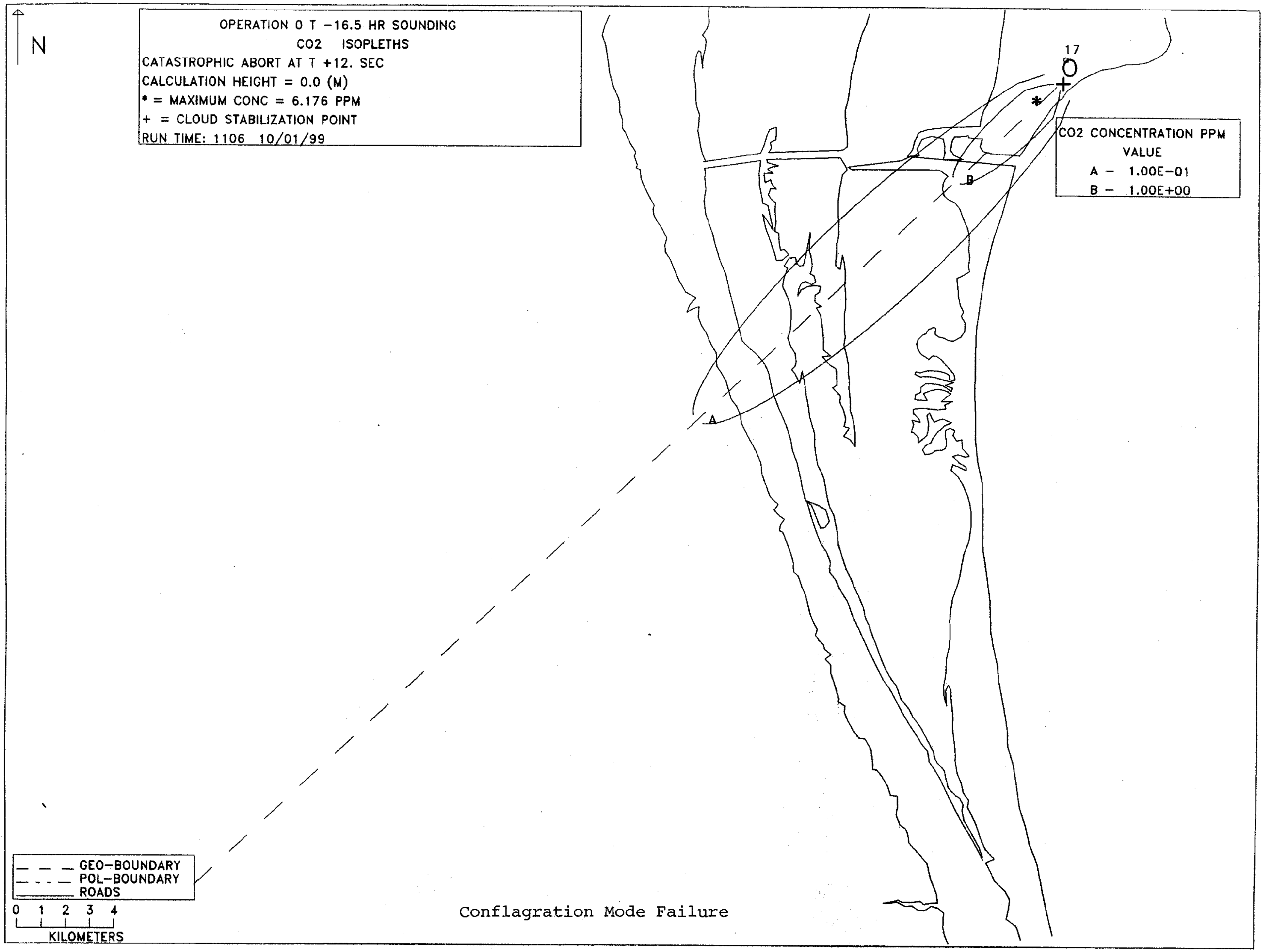
Conflagration Mode Failure



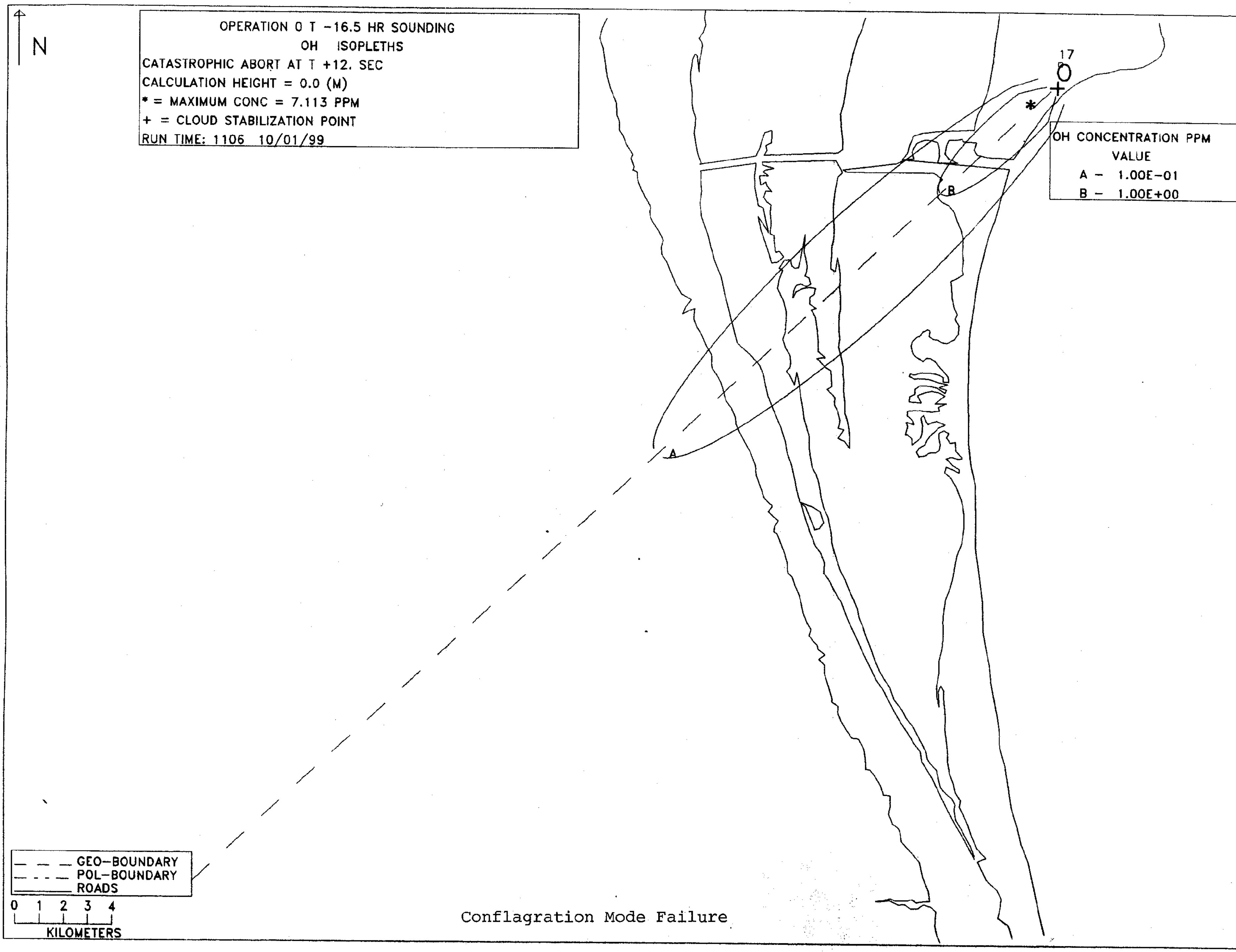
Conflagration Mode Failure



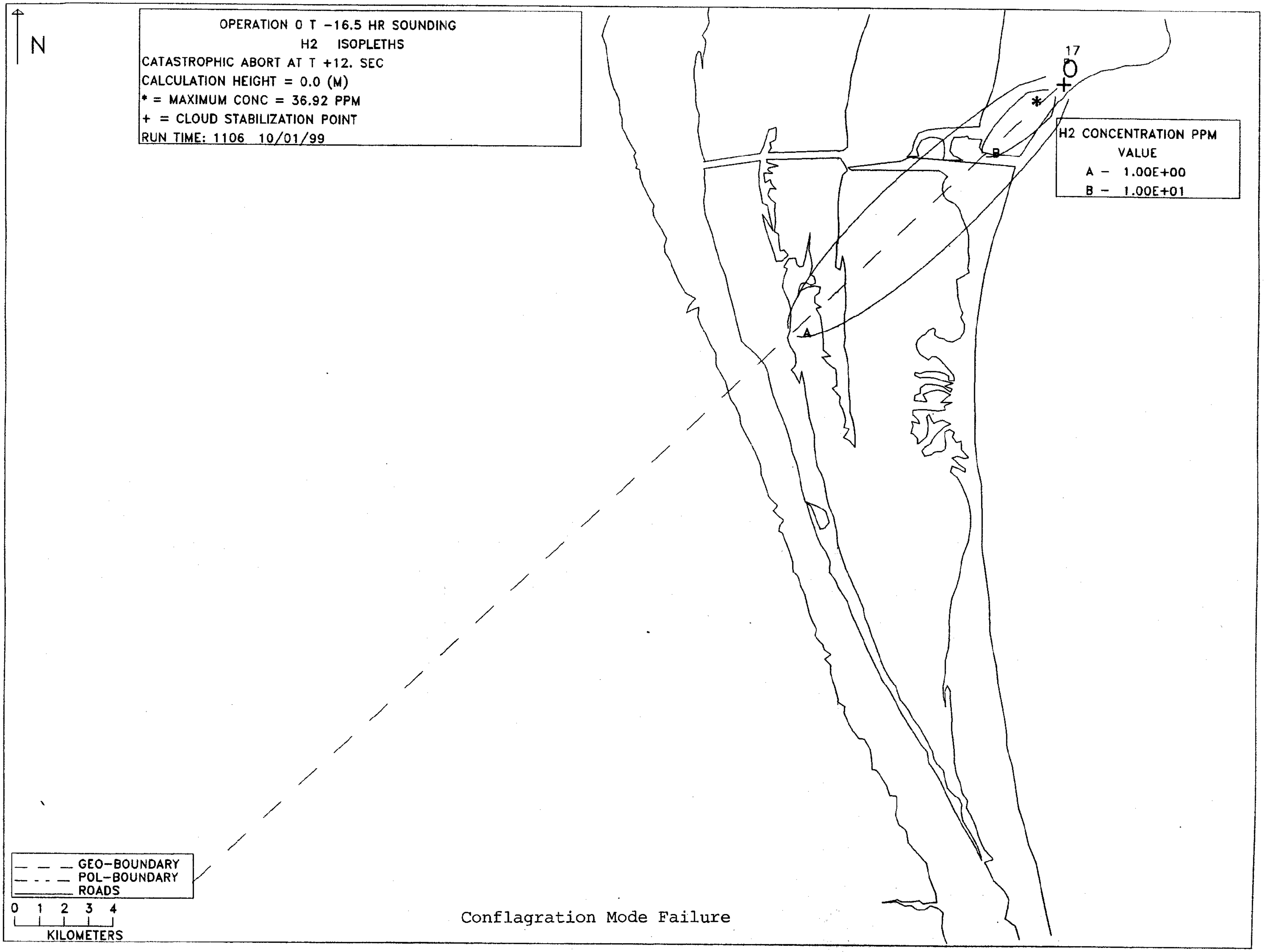
Conflagtation Mode Failure



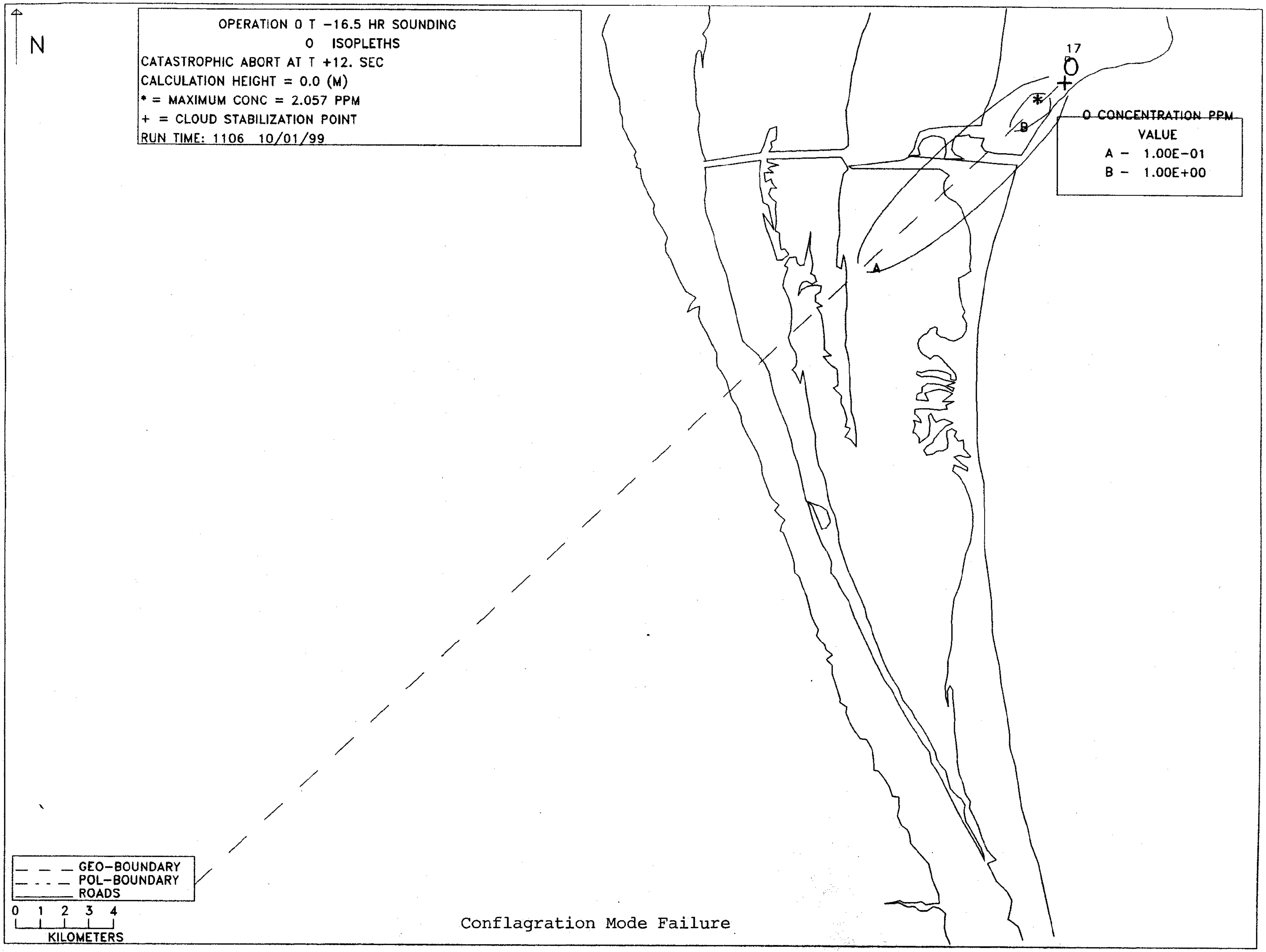
Conflagration Mode Failure



Conflagration Mode Failure



Conflagration Mode Failure



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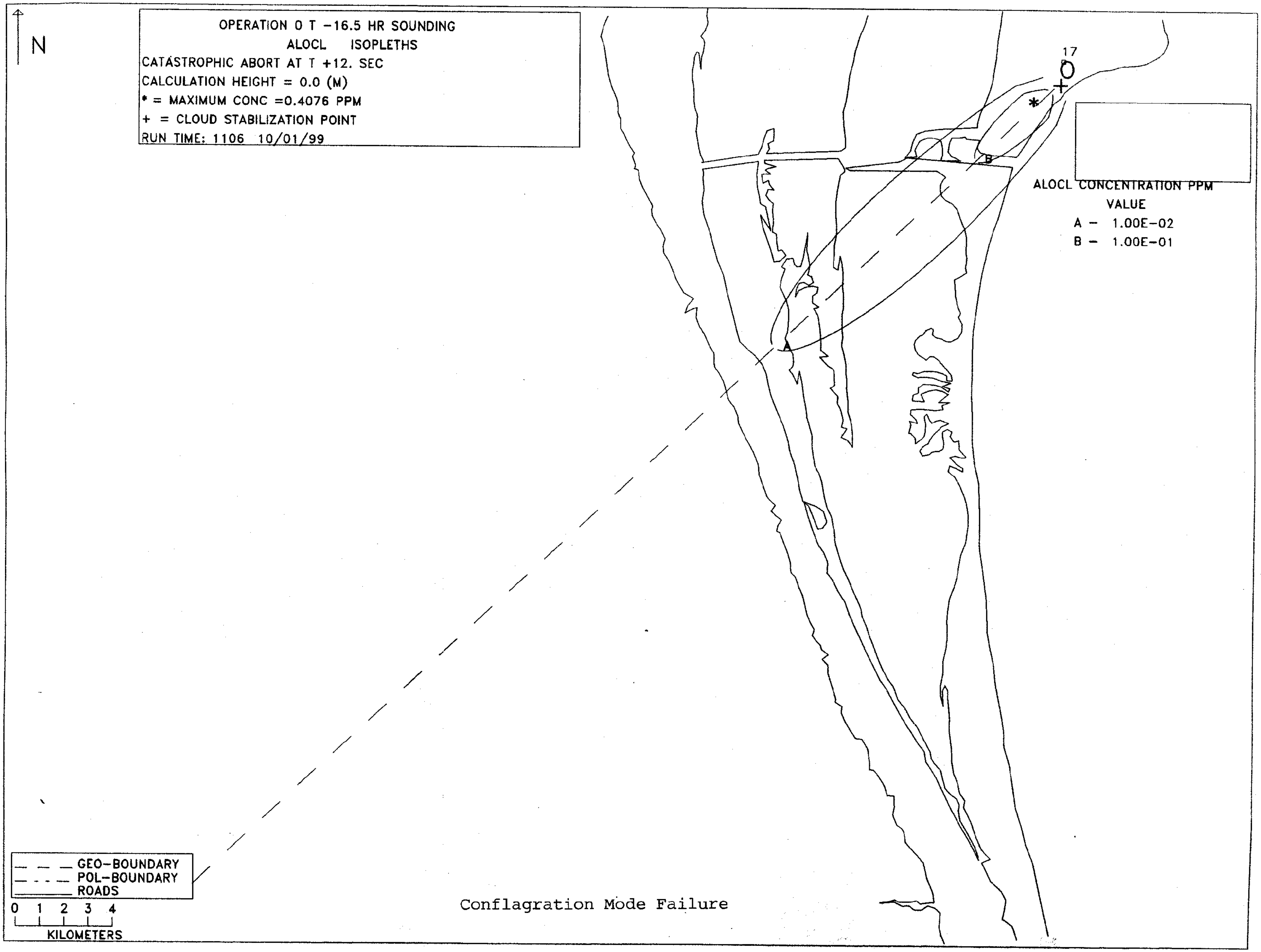
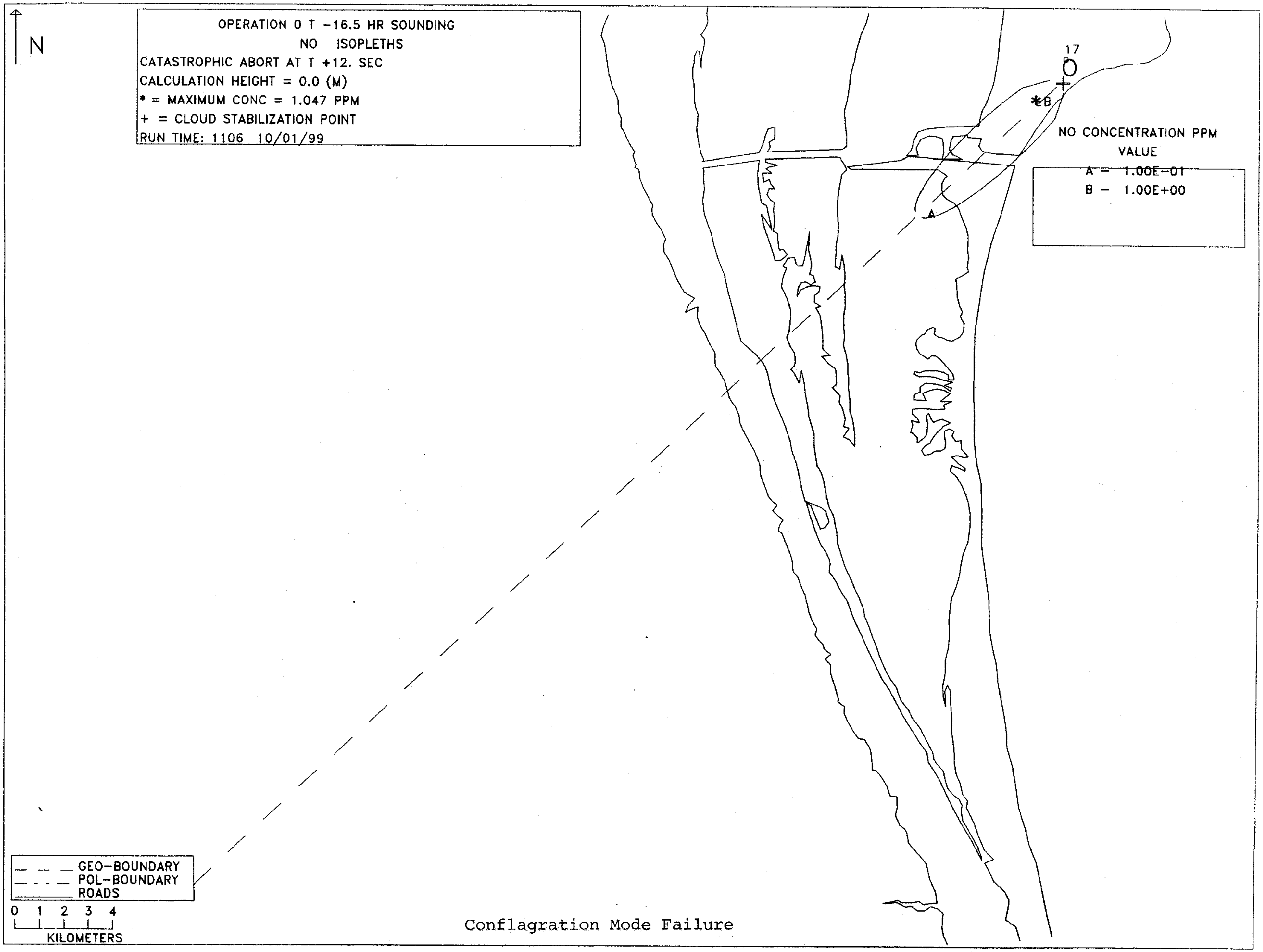
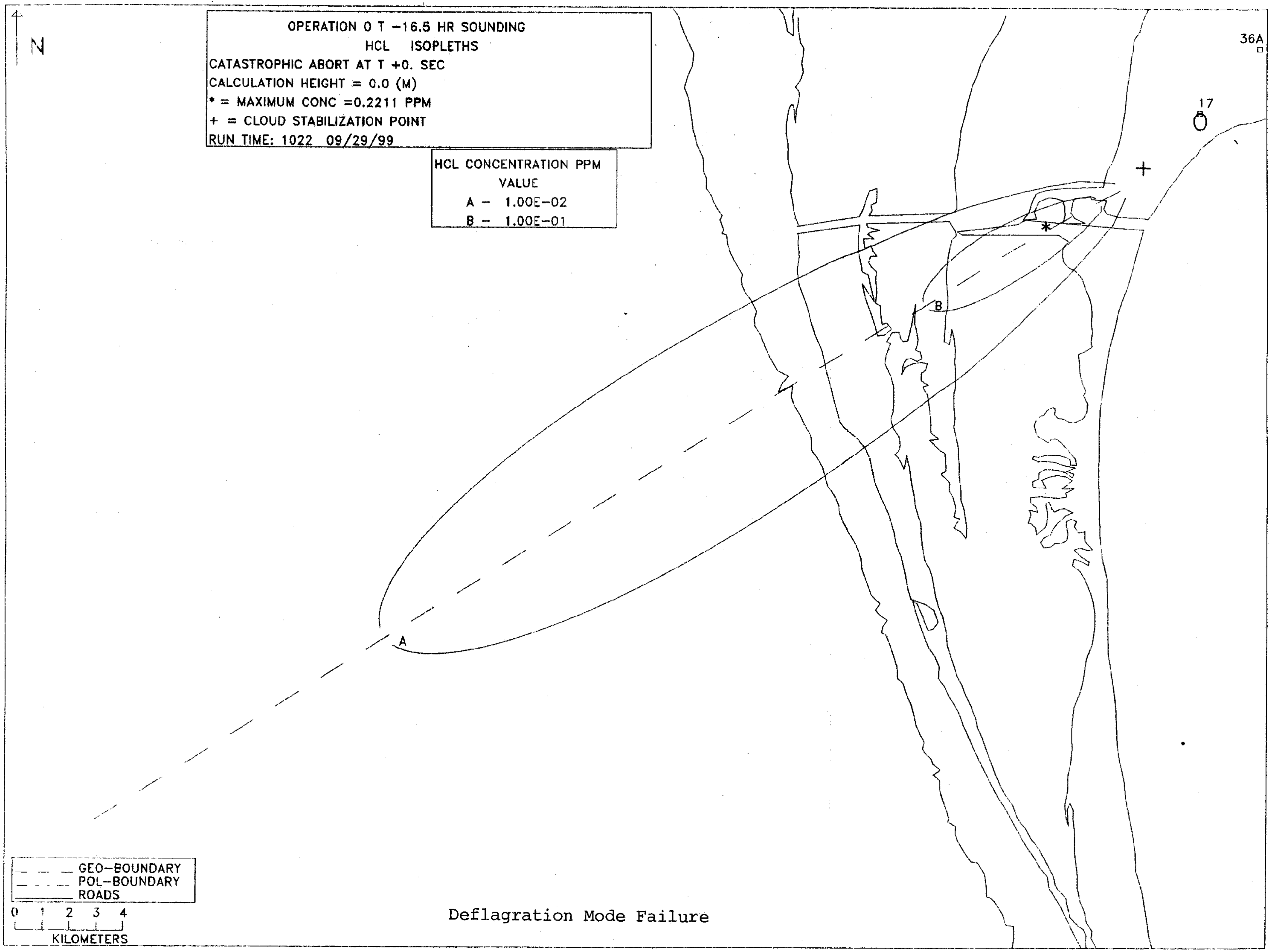


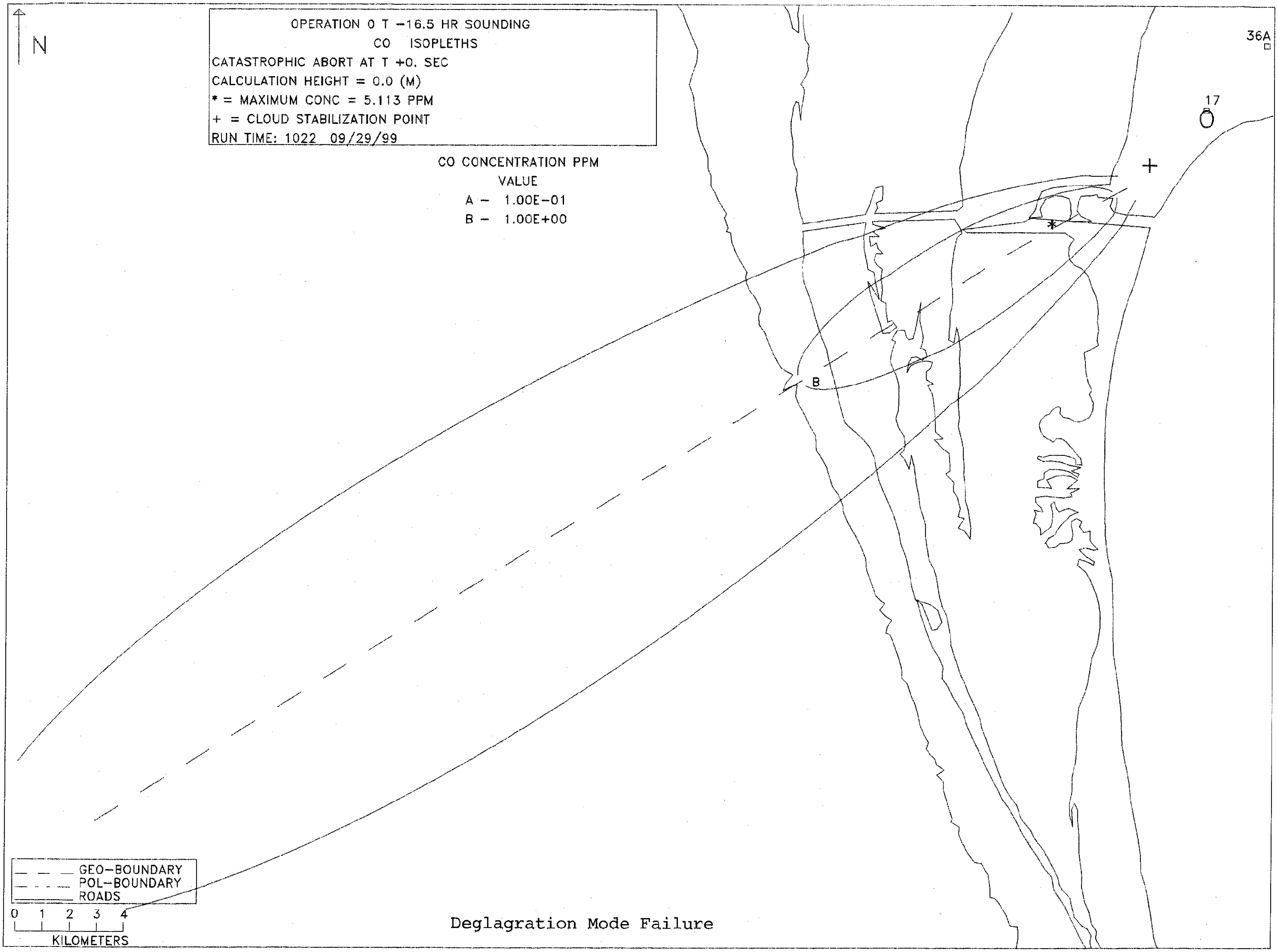
Conflagration Mode Failure

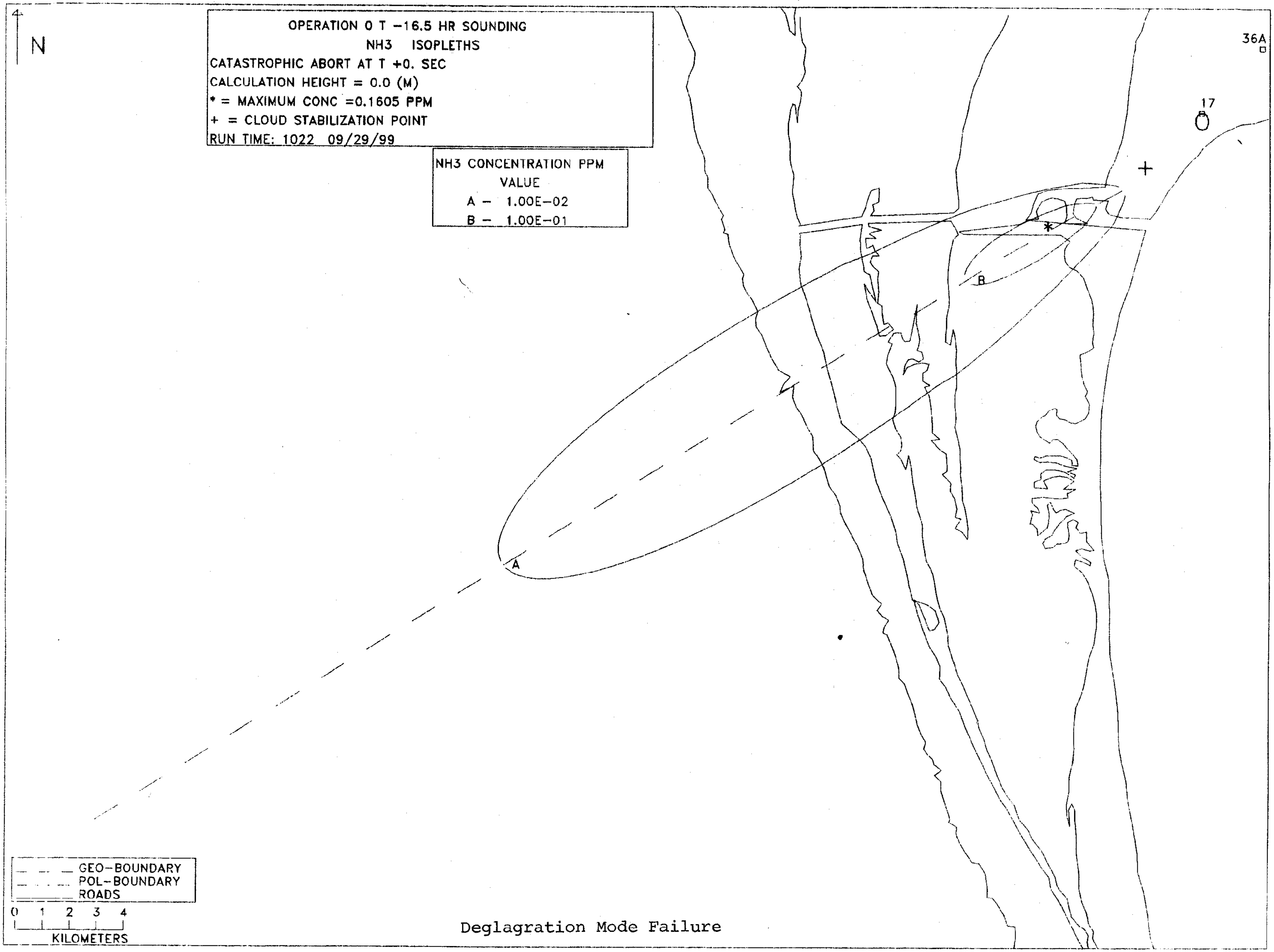


Conflagration Mode Failure

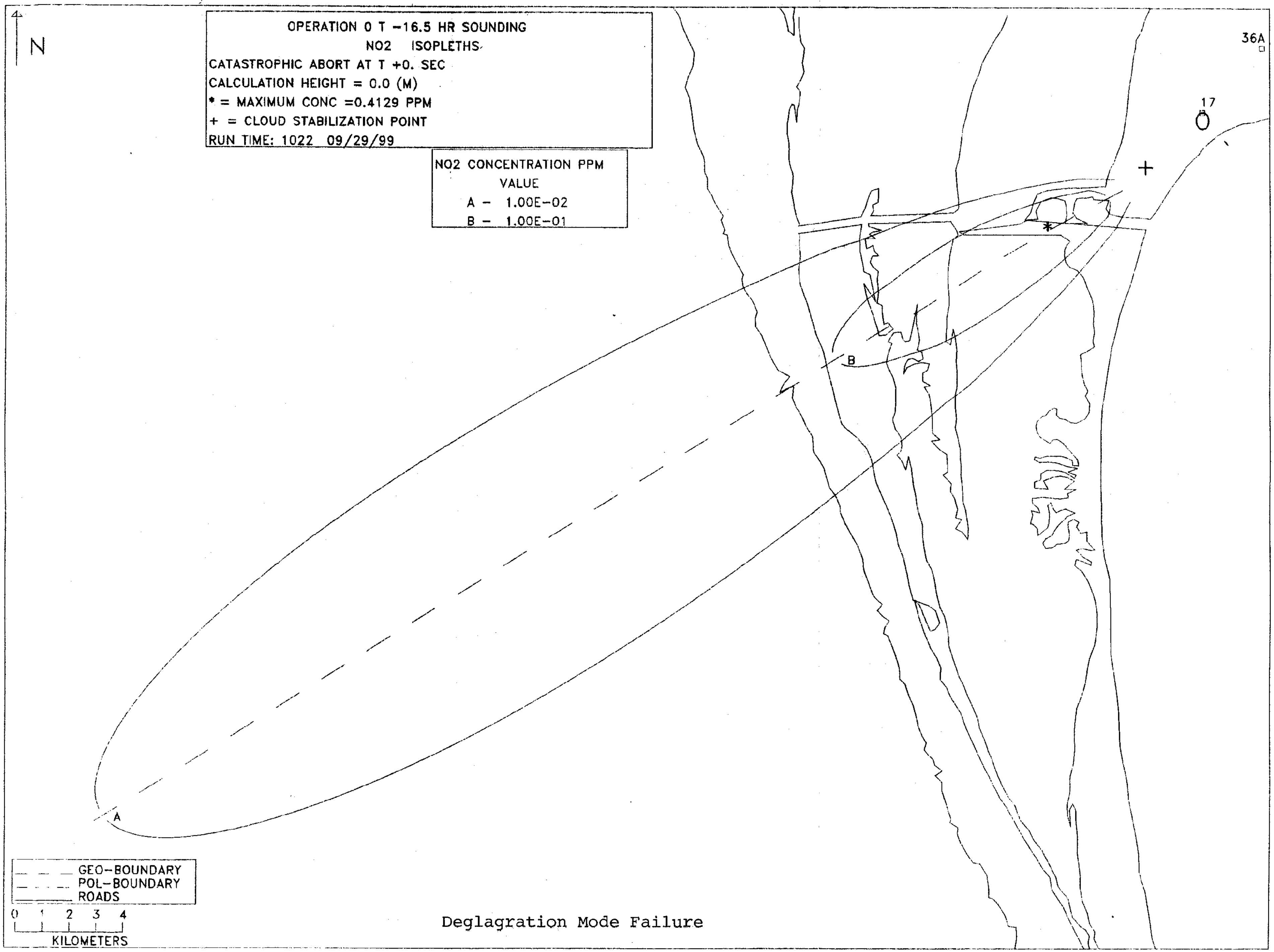


Deflagration Mode Failure

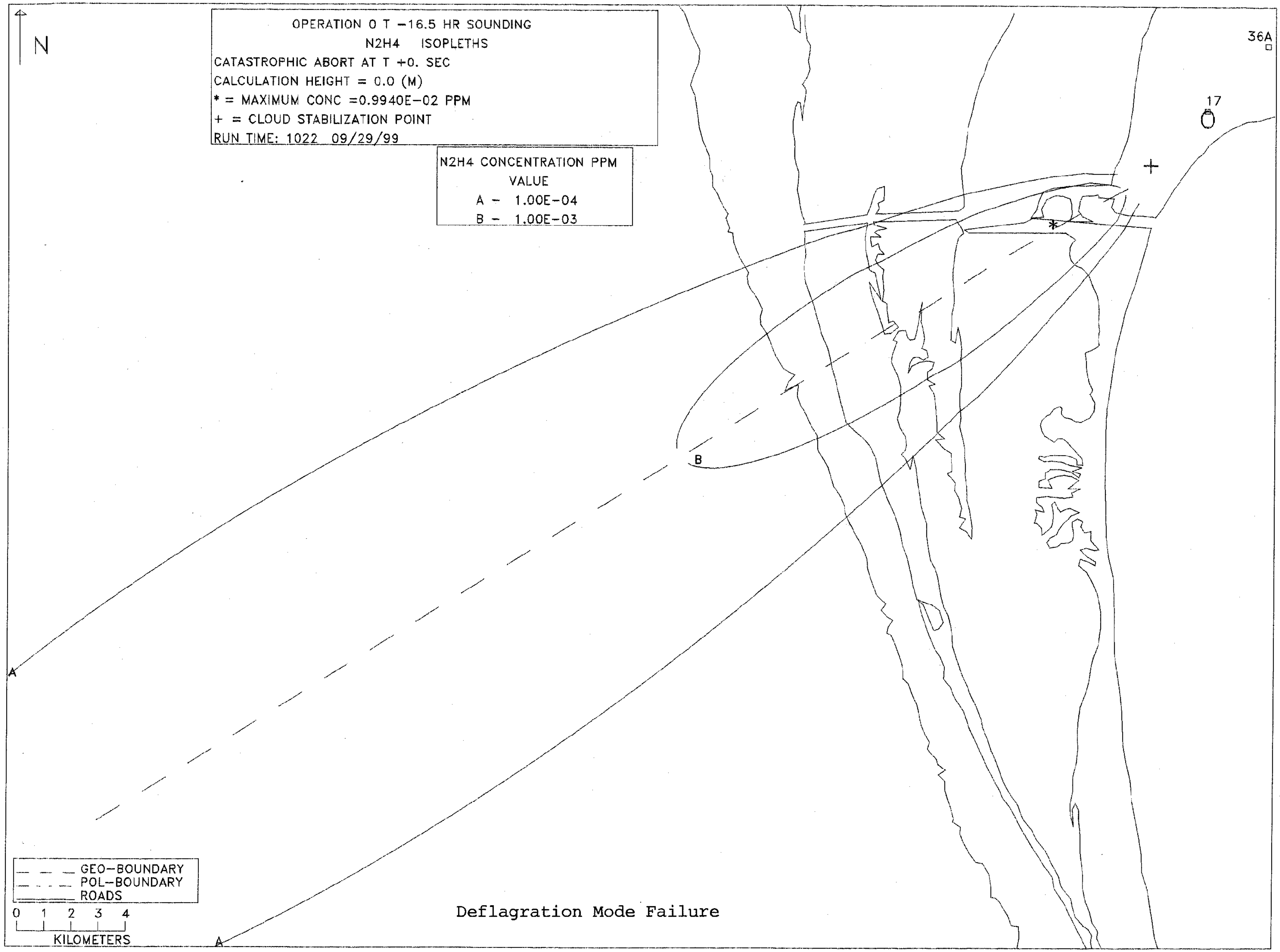

N
OPERATION 0 T -16.5 HR SOUNDING
CO ISOPLETHS
CATASTROPHIC ABORT AT T +0. SEC
CALCULATION HEIGHT = 0.0 (M)
* = MAXIMUM CONC = 5.113 PPM
+ = CLOUD STABILIZATION POINT
RUN TIME: 1022 09/29/99
CO CONCENTRATION PPM
VALUE
A - 1.00E-01
B - 1.00E+00
B
17
36A
GEO-BOUNDARY
POL-BOUNDARY
ROADS
0 1 2 3 4
KILOMETERS
Deglagration Mode Failure



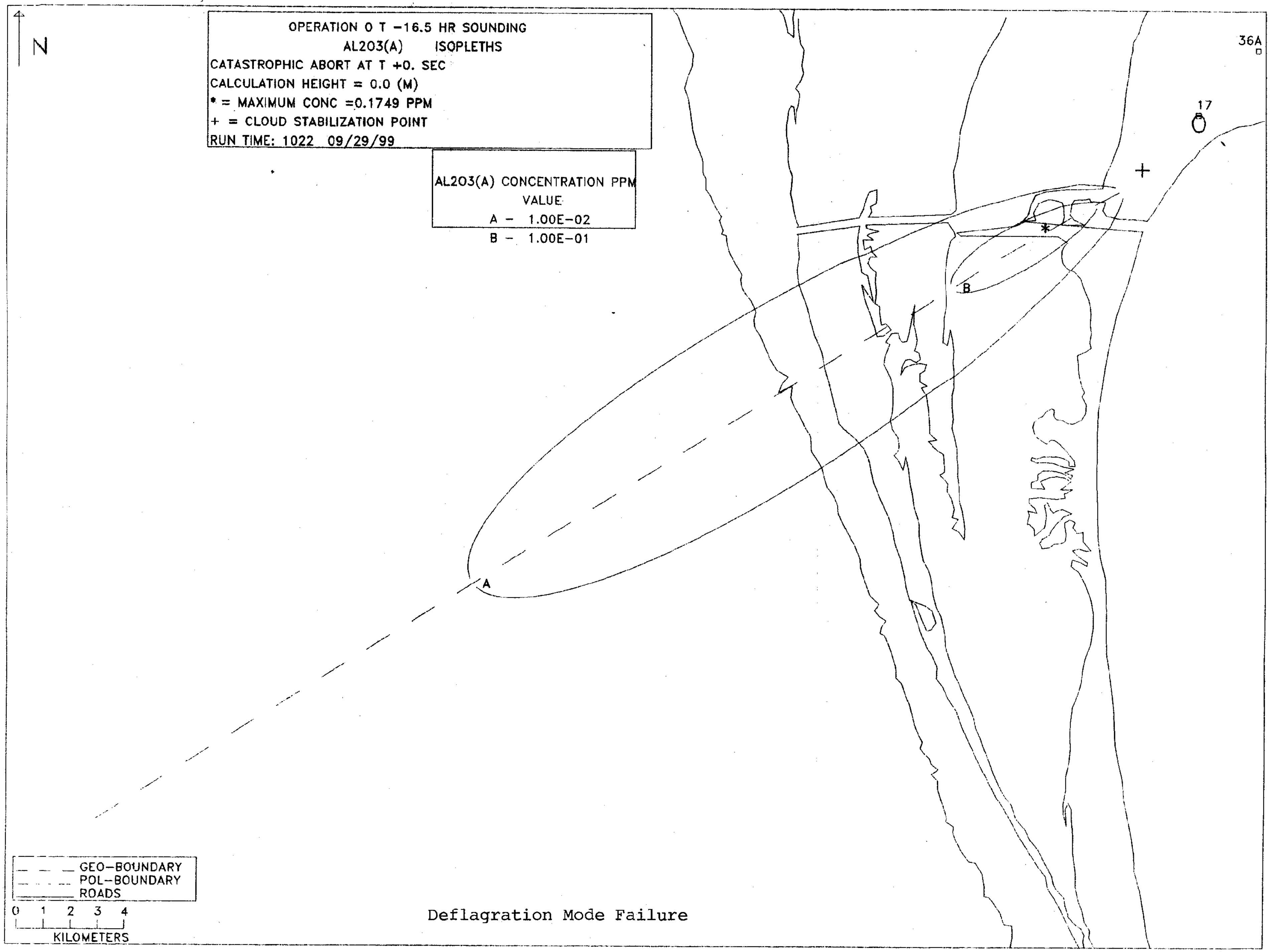
Deglagration Mode Failure



Deglagration Mode Failure



Deflagration Mode Failure



Deflagration Mode Failure