Appendix D – Written Reevaluations and Environmental Findings

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SUBJECT: Written Reevaluation of the Sea Launch Environmental Assessment with Respect to a Proposed Non-Equatorial Launch Azimuth Scenario for the Sea Launch Company

DATE: January 11, 2000

Introduction and Background

Sea Launch Limited Partnership (SLLP) is an international commercial venture formed to conduct commercial space launch operations from a mobile, floating launch platform in international waters in the east-central equatorial Pacific Ocean. The Federal Aviation Administration (FAA) commercial space launch licensing authority in 49 USC Subtitle IX--ch. 701, Commercial Space Launch Activities, §§ 70101-70121 (the Act), authorizes the U.S. Secretary of Transportation to oversee and coordinate U.S. commercial launch operations and to issue licenses authorizing commercial launches and the operation of commercial launch sites. The Secretary is implementing this authority through the FAA's Associate Administrator for Commercial Space Transportation (AST). FAA exercises its licensing authority in accordance with the 14 CFR Ch. III, which authorize the FAA to license the launch of a launch vehicle when conducted within the U.S. and those operated by U.S. citizens abroad. SLLP is a foreign entity controlled by a U.S. citizen. If a foreign entity controlled by a U.S. citizen conducts a launch outside the United States and outside the territory of a foreign country, its launch must be licensed. 49 USC § 70104 (a)(3). The FAA determined that SLLP is a foreign entity controlled by a U.S. citizen, Boeing Commercial Space Company. 49 USC § 70102 (1)(C); 14 CFR § 401.5. Because SLLP proposes to launch in international waters, outside the territory of the United States or a foreign coontry, SLLP must obtain an FAA license to launch. Licensing a launch in the environment outside the United States, its territories and possessions is a Federal action requiring environmental analysis by the FAA in accordance with Executive Order 12114, the FAA's application of which is guided by the National Environmental Policy Act (NEPA) of 1969.

The FAA prepared a Final Environmental Assessment (EA) for Sea Launch Limited Partnership Project (prepared for the Department of Transportation, FAA Office of the Associate Administrator for Commercial Space Transportation, FAA Office of the Associate Administrator for Commercial Space Transportation by ICF Consulting Group and SLLP) which was signed and issued by the FAA on February 11, 1999. The Final EA assessed the proposed actions of constructing, operating and licensing launches of the Zenit-3SL from a mobile, floating launch platform in international waters in the east-central equatorial Pacific Ocean. An Environmental Finding Document, which is the equivalent of a Finding of No Significant Impact (FONSI) pursuant to the National Environmental Policy Act of 1969, was issued on February 11, 1999, after the FAA reviewed and analyzed the available data and information on existing conditions, potential project impacts on the human environment, and measures to mitigate potential impacts. The FAA concluded that licensing the operation of the proposed launch activities was not a major Federal action that would significantly affect the

quality of the human environment within the meaning of Executive Order 12114 and the National Environmental Policy Act (NEPA) of 1969. Therefore the preparation of an Environmental Impact Statement (EIS) was not required. The proposed action as set forth in the Final EA included three launches for the first year of operation and six launches for each subsequent year. As of this date, Sea Launch has successfully launched two Zenit-3SL rockets.

Sea Launch is currently proposing the third launch from the same location in the east-central pacific using a different flight plan.

Sea Launch's application for a FAA launch license for its third mission proposes a non-equatorial launch azimuth to transport a payload into medium earth orbit (MEO). The data and analyses contained in the February 11, 1999, Environmental Finding Document are still substantially valid and Sea Launch states that it will meet all pertinent conditions and requirements of the prior approval, in the current action. The environmental aspects of the third mission are essentially equivalent to the equatorial launch azimuth, geosynchronous transfer orbit (GTO) launches licensed by FAA for Missions 1 and 2. The third mission will utilize the same type of payload, launch vehicle, launch site, and deep and open ocean environments for the stage 1, stage 2 and payload fairing impact zones. As in the first two missions, the flight plan for the third mission is not over any populated land mass until a brief (seven second) very high altitude (over 150 kilometers) traverse of a sparsely populated portion of South America. The third mission is also similar the first two missions in that the flight plan approaches, but does not go directly over, an uninhabited island. For Missions 1 and 2 the flight plan approached the ecologically sensitive Wolf and Darwin Islands of the Galapágos Island group; in the third mission the flight plan approaches but does not go directly over Ducie Island of the Pitcairn Island group, an uninhabited island with only one listed plant species that is neither endemic nor threatened. The very low probability of environmental degradation posed by the third mission are similar to those pose by the first two missions..

Missions 1 and 2	**Third Mission**
Payload, vehicle and launch site	**Payload, vehicle and launch site**
HS 601 payload	HS 601 payload
Zenit-3SL launch vehicle	Zenit-3SL launch vehicle
154°W, 0N° launch site	154°W, 0N° launch site
Stages 1 & 2 & Payload fairing impact zone	**Stages 1 & 2 & Payload fairing impact zone**
Deep and open ocean	Deep and open ocean
Limited vessel traffic	Limited vessel traffic
Low biological productivity	Low biological productivity
Overflight zone	**Overflight zone**
No overflight of populated islands in Pacific	No overflight of populated islands in Pacific
Near, but not over, Wolf & Darwin Islands	Near, but not over, Ducie Island
Short overflight of South America	Short overflight of South America
Risk to humans below FAA standard	Risk to humans below FAA standard

PROPOSED ACTION

A FAA conclusion approving this environmental analysis will support approval of a proposed change to Sea Launch operations for the third mission. The proposed change is the addition of a non-equatorial launch azimuth to transport payloads into MEO.

Reevaluation of Environmental Considerations and Mitigation

The proposed third mission will require a launch toward the southeast to support the placement of a satellite in an inclined MEO (see Figure 1). With the exception of this inclined launch azimuth, Sea Launch's third mission operations will be substantially identical to those addressed in the EA for the Sea Launch Project. The predicted environmental effects of the third mission (i.e. stage and fairing impact) will occur in a different location but in the same type of marine environment as with Missions 1 and 2; therefore, the data and analyses contained in the February 23, 1999, Environmental Finding Document are still substantially valid and all pertinent conditions and requirements of the prior approval have or will be met in the current action. (The failed mission scenario is described in detail on page 13.)

The third mission flight travels over water that ranges from 1,500 to 4,500 meters deep, except in the area of Ducie Island where the water remains deep to within a few kilometers of the island itself, and the brief transit of South America. Although the ocean areas traversed can be considered predominantly open ocean, the relative closeness of a number of islands and reefs in French Polynesia and the Pitcairn Island group has contributed to the formation of a slightly more biologically productive ecosystem when compared to a launch due east along the equator.

The risks to human safety and probability of environmental impact discussed in the EA for Missions 1 and 2 are analogous to those posed by the third mission. In addition, the risks and probability of impact are within FAA standards and guidelines.

The Zenit-3SL launch vehicle described in the EA is the same one proposed for use for the third mission, and the elements of the third mission payload are addressed in the EA. Appendix A of the EA describes the processing of the payload and fueling prior to mating to the launch vehicle. The third mission payload uses a monopropellant propulsion system of Anhydrous Hydrazine fuel (two tanks with 173 kg/tank or 345 kg/spacecraft) pressurized with Helium (initial pressure of 23.8 bars). Several small-scale explosive devices incorporated in the payload are used to activate valves, separation devices, and other similar hardware components. The following materials used in the third mission payload construction are typical of those used in spacecraft construction.

- Aluminum
- Aluminum Honeycomb
- Graphite/Epoxy
- Steel

- Titanium

As with the earlier missions, there are no radioactive materials or emission sources on the third mission. There is non-ionizing radiation associated with the third mission payload from two sources, the Ku-band payload and the Telemetry Tracking Command and Ranging (TTC&R) subsystem. These sources present no radiation concerns that would require additional safeguards other than those already discussed in the EA for health and safety issues. There are no unique exhaust products associated with the Zenit-3SL third mission launch vehicle that are not addressed in the EA.

Sea Launch Mission 3
Nominal Impact Areas

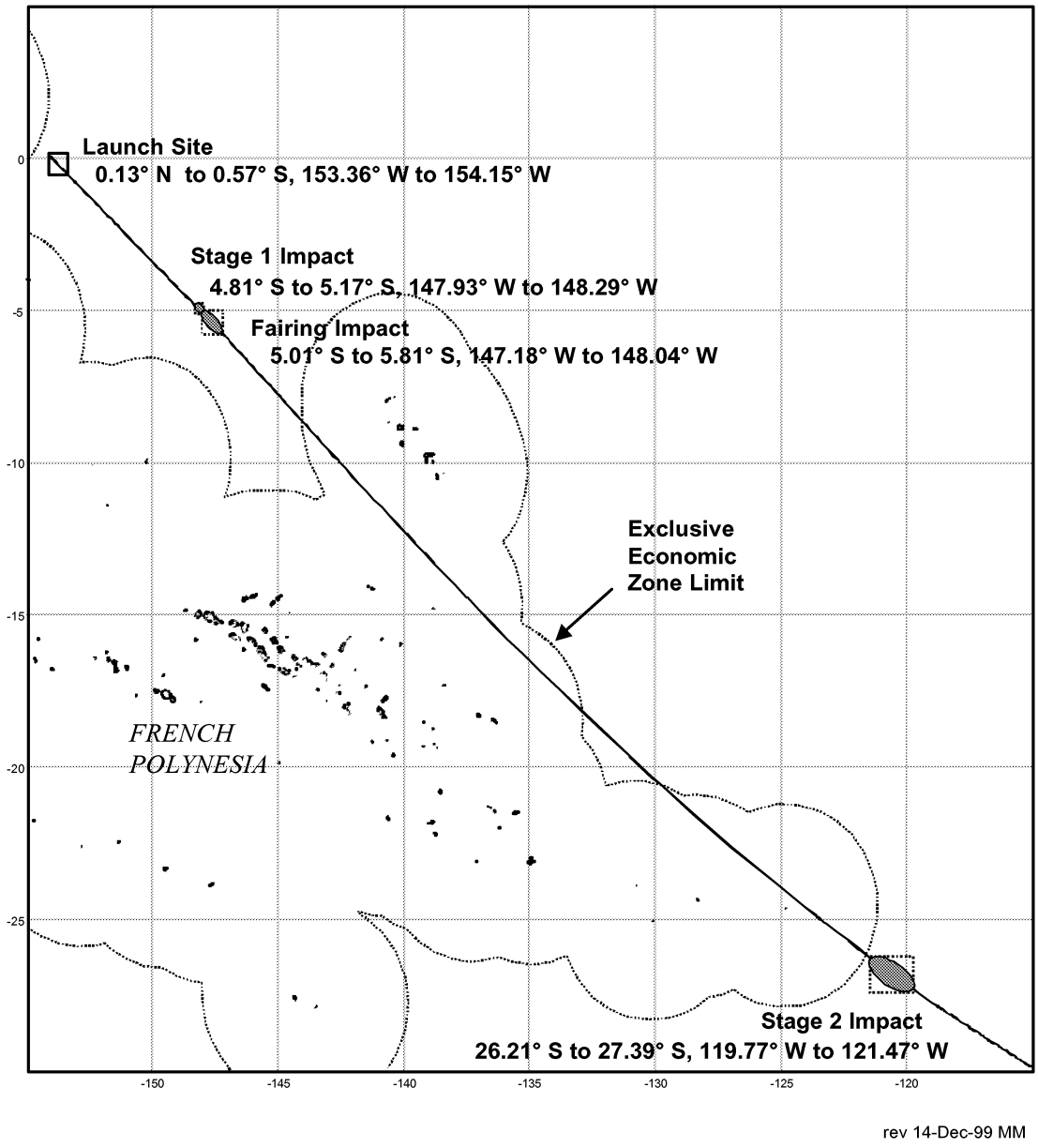

Figure 1: Third mission Non-Equatorial Groundtrack

AFFECTED ENVIRONMENT

First stage flight of the third mission azimuth will begin in international waters at 154° W on the equator, transit over international waters, and terminate following stage 1 separation over international waters at approximately 148.11° W and 4.99° S. The second stage powered flight will include a series of small yaw maneuvers. These will adjust the groundtrack so that the instantaneous impact point (IIP) traverses open waters in the vicinity of French Polynesia and the Pitcairn Island group and beyond, until the second stage separates and impacts in international waters at approximately 121.07° W and 26.38° S. The impacts in international waters corresponding to the separation of the first and second stage occur outside the area covered by the Convention for the Protection of the Natural Resources and Environment of the South Pacific Region. Under normal operational conditions, any impacts from the stages are expected to occur outside the 200-nautical mile exclusive economic zones. The third stage will begin powered flight over international waters, and propel the third stage and satellite payload toward the southern tip of South America. The third stage and payload fly over a very mountainous and sparsely populated area of South America for seven seconds.

In its traverse of deep and open ocean the groundtrack of the rocket in the first 250 seconds after liftoff in third mission is basically equivalent to that described in the EA for an equatorial launch-i.e., Missions 1 and 2 (except that it is following a path that is a 45° angle to the SE of the equator rather than along the equator). Likewise, the groundtrack after 450 seconds following liftoff in the third mission may be considered equivalent to the traverse of equatorial waters described in the EA because the downrange ocean environment overflown by the third mission is comparable to that overflown by Missions 1 and 2. It is an open, deep-water region (1,500 to 4,500 meters) far removed from land, with few differences from the equatorial open-ocean environment described in the EA except that the prevailing currents in this area of the South Pacific are east to west driven by the trade winds (Pickard and Emery, 1990), and there is noticeable but not extreme seasonal variability in solar radiation, which is a function of latitude. Nutrient and productivity levels in this area, along with the expected occurrences of species of concern, would be similar to that described in the EA (see EA Section 3.3). Similarly, the period of the third mission flight over South America corresponds roughly to the equatorial transiting of the continent as discussed in the EA, although the third mission has a shorter transit time (seven seconds as opposed to twenty seconds with an equatorial launch), and the area of South America overflown has a lower population density.

The third mission presents considerations unique when compared to missions 1 and 2 only during the portion of flight from approximately 250 to 450 seconds after liftoff, a duration of about 3 minutes, when the launch vehicle is over the exclusive economic zones of French Polynesia and the Pitcairn Island group (see Figure 2). In the third mission the vehicle will travel closer to islands and reefs than the equatorial missions described in the EA.

A review of a sea lane chart suggests that this inter-island area would have an equivalent frequency of freight, passenger, and commercial vessel traffic as compared with the equatorial region between Kiritimati (i.e., Christmas Island) and the Galapágos Islands off South America (see Figure 3; see also Box 1 for a listing of commercial shipping service in the South Pacific region). Subsistence fishing vessel traffic, however, is assumed to be greater in this inter-island area than in the equatorial region between Kiritimati and the Galapágos Islands, due to the closer proximity of island population centers within French Polynesia and the Pitcairn Island group.

There is also likely to be small-scale inter-island shipping, especially between the islands of French Polynesia. The frequency of this vessel traffic is impossible to quantify because data are not available.

As regards fishing in the vicinity of the area, the flight plan crosses the exclusive economic zones, but not French Polynesia or the Pitcairn Islands themselves. Within these zones there is some degree of subsistence fishing, pursued in the vicinity of the inhabited islands by small vessels on short-duration excursions. In addition to subsistence fishing, there is a commercial fishery operating within the waters of French Polynesia (FAO, 1999). This is primarily a tuna fishery (Flint, 1999), requiring larger vessels to locate and capture this open-ocean, migratory species. Unlike subsistence fishing where vessel distributions would follow island population distributions, tuna fishing fleets would be more randomly distributed, dependent on the seasonal availability and distribution of the species. The flight plan of the third mission and the deep water impact areas for the stages and fairing decent suggest that impacts on fishing activities in the vicinity would be comparable to the impacts described in the February 11, 1999, Environmental Finding Document.

Mission 3 Instantaneous Impact Point Trace – 45deg inclination

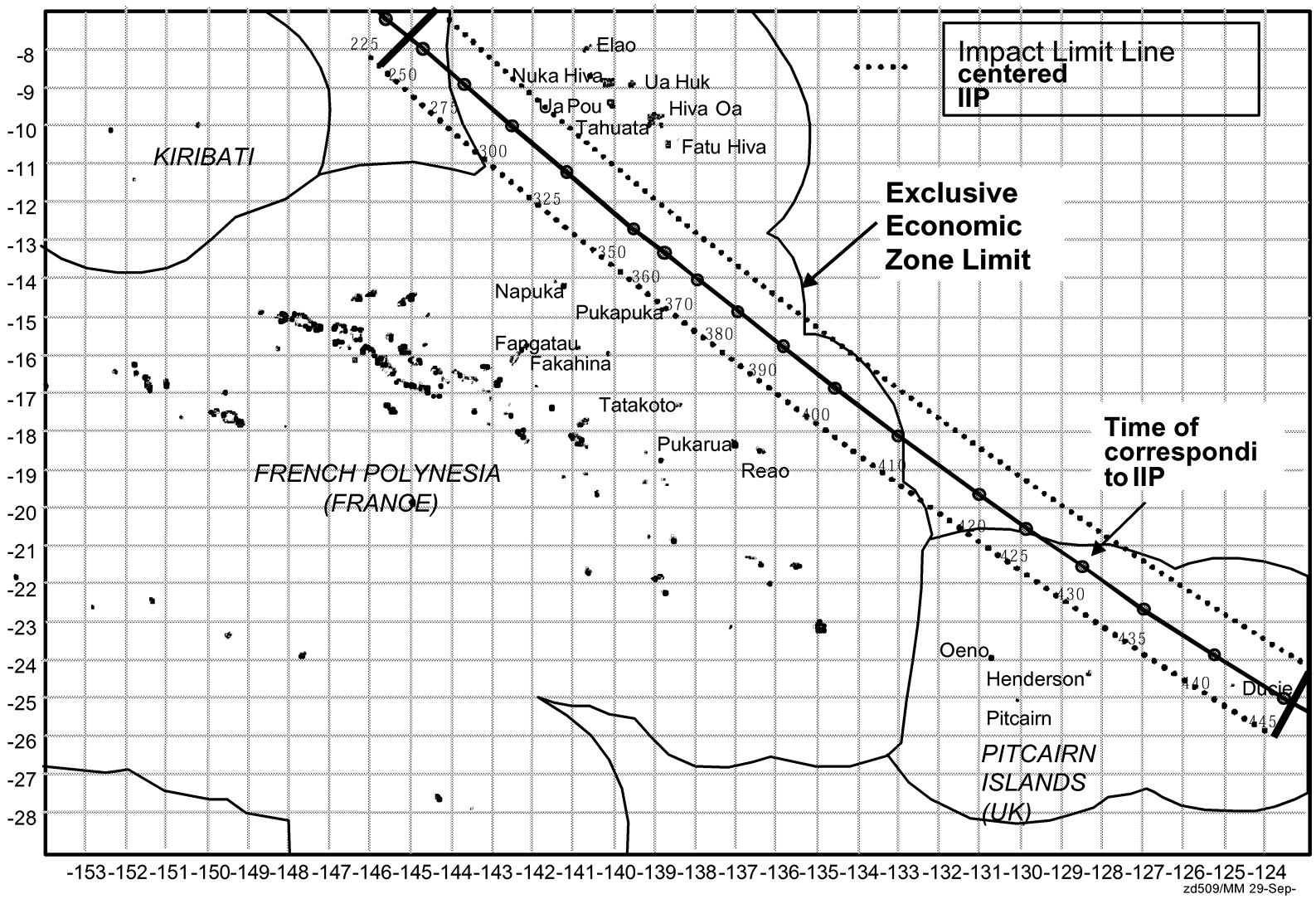

Figure 2: Groundtrack Between 250 and 445 Seconds After Launch

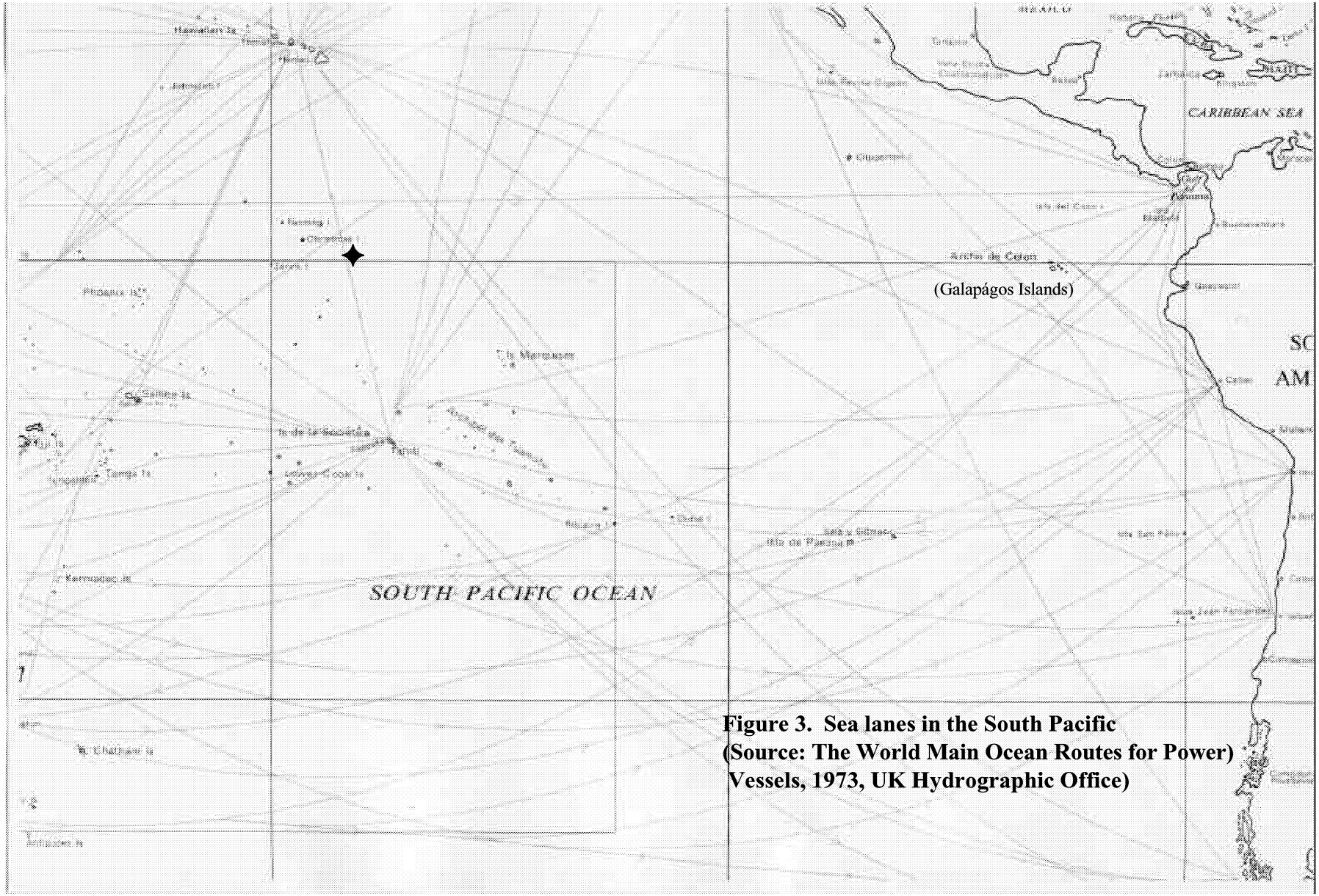

Figure 3. Sea lanes in the South Pacific
(Source: The World Main Ocean Routes for Power) Vessels, 1973, UK Hydrographic Office)

Box 1: Shipping Service in the South Pacific Region

•Australia - New Zealand Direct Line (ANZDL): service every 2-3 weeks from Melbourne, Sydney & Tauranga to Tahiti & Fiji.

•Bali Hai (Swire / NYK / Kyowa): 3 ship service from Hong Kong, Korea & Japan to Micronesia; South through Fiji to Samoa, Tahiti, Tonga, New Caledonia, Vanuatu and return to Hong Kong.

•Bank Line (Andrew Weir Shipping): 4 ship service ex UK and Europe to Tahiti, New Zealand, Fiji, Solomon Is. and P.N.G then via Singapore & Suez to Europe.

•Columbus Line: Fortnightly service in conjunction with P&O Nedlloyd from Australia and New Zealand to Fiji, Tahiti and Hawaii and Fiji south bound from US West Coast. Three-weekly service from US to Tahiti, American Samoa, Samoa & Tonga.

•CGM / Marfret: Round the world service ex Europe to Tahiti, New Zealand, New Caledonia, Australia, then Westward to Europe via S.E.Asia, in conjunction with Contship Containerlines.

•Contship Containerlines (CP Ships): Round the world service ex Europe to Tahiti, New Zealand, New Caledonia, Australia, then Westward to Europe via S.E.Asia, in conjunction with CGM/Marfret.

•FANAL (Fesco): Fortnightly service ex Australia & New Zealand to Fiji and Tahiti & from USWC to Tahiti.

•P&O Nedlloyd : Fortnightly service in conjunction with Columbus Line from Australia and New Zealand to Fiji and Tahiti and Fiji south bound from US West Coast.

•PDL(Pacific Direct Line): 1 ship service with NZPCL from New Zealand to Norfolk Island, New Caledonia, Wallis and Futuna, Tuvalu; 1 ship service with NZPCL to Samoas, Tonga & Niue; NVOCC service with NZPCL from NZ to Fiji and from Australia to Noumea, Fiji, Samoas & Tonga; NVOCC service to Tahiti.

•Polynesia Line: 1 ship service from US West Coast to Tahiti, and American Samoa. Contract carrier to one of the Tuna canneries in American Samoa.

•SPCL (South Pacific Container Line): 1 ship service US West Coast to Tahiti, American Samoa. Contract carrier to 2nd Tuna cannery.

Source: "Shipping in the South Pacific," Web Site, at www.oceanz.co.nz/spac.htm, on 11/11/99.

The precise area of interest under a failed mission scenario—the impact limit line (ILL)—is a near-rectangular wedge in which the centerline is the stage 2 IIP from approximately 144° W and 8° S to 124° W and 27° S. The long sides of the wedge are found at an expanding distance on either side of the groundtrack from 50 kilometers in the northwest to 100 kilometers in the southeast (see Figure 4). ILLs were established by SLLP to determine where debris would fall. A statistical confidence level based on three standard deviations was used to quantify the dispersions that could cause the debris to fall within this flight corridor if a catastrophic failure were to occur. The ILLs incude dispersions in launch vehicle guidance, navigation and control systems, as well as atmospheric wind effects. That is, if a catastrophic failure occurs—in this case, debris falling associated with a failed mission—the degree of certainty that the effect would take place within the area defined by the ILL is 99.74%; alternatively, the chance that the effect would take place outside the area would be 0.26%, or roughly 1 in 400. It is important to remember that the risk of the effect happening outside the ILL must incorporate both the 3-sigma boundary as well as the estimated chance of the failed mission scenario; consequently, the risk of debris falling outside the ILL would be less than 1×10^{-11}. For normal operations, the area defined within the ILL will be unaffected by the launch vehicle passing overhead, since the planned return-to-earth of stages 1 and 2 occur well before and after overflight of this area, respectively, in international waters.

One island in the Pitcairn Island group, Ducie Island, is within the boundaries of the ILL for the failed mission scenario (e.g., the 3-sigma lateral dispersion envelope). Ducie Island is the smallest of four subtropical islands in the Pitcairn Island group. Ducie Island (Lat. 24.67° S, Long. 124.80° W) is an elevated coral atoll ecosystem (maximum elevation is 4 meters) which encompasses 0.7 square km. The Island is composed of one terrestrial ecosystem (a tree heliotrope forest, covering 70% of the island) and three marine ecosystems. The marine ecosystems include windward and leeward atoll reefs with extensive algae in shallows and coral on deeper reefs, and a poorly circulating lagoon with fair coral cover on the pinnacles. The coral accounts for 99% of the island's shoreline. Reported wildlife use consists of a seabird rookery as well as the presence of invasive Polynesian rats, lizards, the masked booby, Murphy's petrel, the common fairy tern, and the frigate bird (Lonely Planet – Destination Pitcairn Islands Web Site). No endemic or threatened floral or faunal species are reported to be on the island. The island is uninhabited, seldom visited, and largely undisturbed. (UN System-Wide Earthwatch Web Site). Impacts to Ducie Island associated with the failed mission scenario, if they occur, would be minor and have short-term environmental effects only (see Environmental Impacts, page 13, "Failed Mission Scenario"), and would be comparable to the impacts described for the Galapagos Islands in the February 11, 1999, Environmental Finding Document.

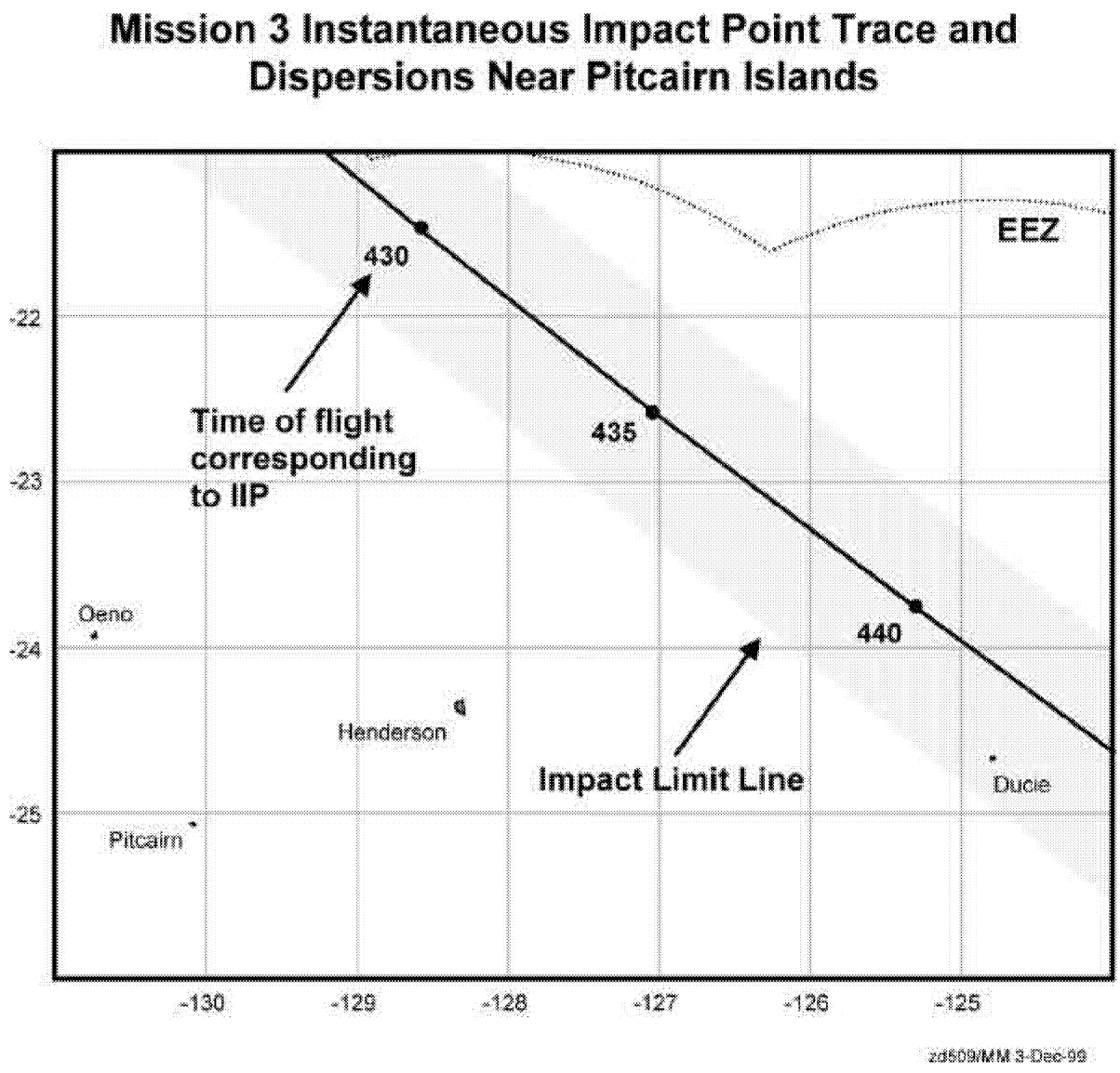

Figure 4: Flight azimuth of 45º in the Vicinity of Ducie Island

ENVIRONMENTAL IMPACTS

Air Quality and Atmospheric Emissions

The proposed change will not create a new impact on air quality or atmospheric emissions. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Water Quality

The proposed change will not create a new impact on water quality. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Noise

The proposed change will not create a new impact on noise. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Waste

The proposed change will not create a new impact on waste generation and management. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Biological and Ecological Impacts

The proposed change will not create a new impact related to biological or ecological activity. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Social and Economic Considerations

The proposed change will not create a new impact related to social or economic considerations. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document. In addition, because of the change in flight plan, the list of recipients of "notification of mariners and other interested parties," as specified in Sea Launch's Environmental Monitoring and Protection Plan, will be evaluated and adjusted accordingly.

Health and Safety

FAA's licensing process will examine safety aspects of the proposed launch operations. The SLLP adopted as a population protection risk criteria, an upper limit of one in a million casualty expectation. Public safety assurances and analysis issues are discussed in the SLLP document "Sea Launch Systems Safety Plan". The Launch location was shifted away from land and America to ensure that stage 1, the fairing and stage 2 would drop well away from land and coastal commercial activity/

The proposed change will not create a new impact in the area of health and safety. Impacts in this category and the corresponding mitigation program will be similar to those noted in the final EA and the Environmental Finding Document.

Threatened and Endangered Species

The proposed change will not create a new impact regarding threatened or endangered species. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Archeological and Cultural Resources

The proposed change will not create a new impact in relation to archeological and cultural resources. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Home Port Activities

The proposed change will not affect home port activities.

Energy Outputs

The proposed change will not affect energy outputs. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Environmental Justice

The proposed change will not create a new impact concerning environmental justice. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Cumulative Impacts

The proposed change will not affect cumulative impacts. Cumulative impacts will be similar to those noted in the Final EA and the Environmental Finding Document.

Failed Mission Scenario

Under the failed mission scenario, the third mission's proximity to Ducie Island poses a risk to the environment event equivalent to the proximity of Wolf and Darwin Islands of the Galapágos Island Group during an equatorial launch mission. This latter case is described in Section 4.3 of the EA. A similar failure analysis relative to Ducie Island is provided below. The various hazard scenarios for this phase of the ascent trajectory and the theoretical casualty expectation confirm the very low risks expected from possible failures during this phase of flight.

The third mission flight plan presently accommodates a flight azimuth of 45°, as represented in Figures 2 and 4 above. The altitude of the vehicle will be over 150 kilometers when approaching Ducie Island. The third mission flight plan allows the ILL, but not the groundtrack (or IIP), to traverse Ducie Island.[1] The alternative, i.e., having the ILL also bypass the island, would have required an increase in the number of in-flight maneuvers, each of which negatively affects vehicle safety and reliability, because the risk of failure is usually higher during dynamic state changes (e.g., attitude changes) when compared with steady-state flight behavior.

During the traverse through the vicinity of French Polynesia and the Pitcairn Island group, stage 2 will be undergoing a steady engine burn and acceleration. Historical performance reliability of this stage during this time of flight, as demonstrated by performance in both Zenit-2 and Zenit-3SL vehicles, is better than 97%. The corresponding risk and potential scale of impact to the aquatic ecosystem and vessels in the area from such a failure are, therefore, also extremely small.

In the case of Ducie Island, the launch vehicle groundtrack will pass by the island for a duration of less than 0.5 seconds, approximately 443 seconds after launch, at an speed of over 10,000 meters per second (36,000 kilometers per hour). Additionally, the IIP for the 45° inclination will be approximately 40 kilometers from the island, and the corresponding ILL will parallel both sides of the IIP at a distance of approximately 100 kilometers. As a statistical concept, therefore, the ILL boundary will encompass Ducie Island, and its surrounding reefs as the IIP traverses the ocean surface. Given the launch vehicle's speed and altitude, however, the probability is extremely small that failure would occur at the moment the IIP passes abeam or nearly abeam the island. This is during a time when the propulsion and control systems have been stable for several minutes and, therefore, are less susceptible to failure as mentioned

[1] Henderson Island, a World Heritage Site as of 1988, also one of the Pitcairn Islands, would be approximately 270 kilometers from the flight plan of the launch vehicle, and approxamately 180 kilometers from the end of the impact limit line (ILL), corresponding to the 3-sigma lateral dispersion. Therefore, even under the failed mission scenario, there is no impact predicted for Henderson Island. Other islands in the vicinity of the flight plan are also outside the ILL (e.g., Pukapuka is an uninhabited island with no endangered or threatened species, and Ua Pou is an uninhabited island with 6 plant species and 2 bird species considered threatened) and therefore are predicted to experience no impact even under the failed mission scenario.

above. Further, in the event of a failure during this moment in time, debris from the failed launch vehicle is likely to burn, fragment, and scatter as it returns to earth. Specifically, the stage 2 and payload structures would immediately tumble and rupture; the fuel and propellants would disperse and immediately vaporize and burn; and virtually all of the hardware components would fragment into small pieces, most burning during re-entry. Given the groundtrack IIP separation from the island, the probability that a surviving piece of the dispersed set of debris would strike Ducie Island or the reef extending out from the island is calculated to be one in one billion or 1.1×10^{-9} and therefore produces a negligible chance of environmental effects. This analysis for Ducie Island follows the same method and yields comparable results as the analysis documented for Wolf and Darwin Islands in EA Section 4.3.4.2 and EA Appendix E on Galapágos overflight risk.

CONCLUSIONS

Based on the above review and in conformity with FAA Order 1050.4D, paragraph 92, the FAA has concluded that the proposed change to a non-equatorial launch azimuth for the third mission Sea Launch operations conforms to the prior approved Environmental Finding Document and Final EA, that the data contained in the approved EA and Environmental Finding Document are still substantially valid, that there are no significant environmental changes, and that all pertinent conditions and requirements of the prior approval have been met or will be met in the current action.

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Environmental Finding Document Finding of No Significant Impact

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US DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Environmental Finding
Written Reevaluation of the Sea Launch Environmental Assessment with Respect to a Proposed Non-Equatorial Launch Azimuth Scenario for the Sea Launch Limited Partnership

On February 11, 1999, the FAA accepted a final Environmental Assessment evaluating proposed launch activities from a mobile, floating launch platform in international waters in the east-central equatorial Pacific Ocean by the Sea Launch Limited Partnership (Sea Launch). The covered actions as evaluated in that Environmental Assessment included six launches per year on an approximate equatorial launch azimuth. Based on that Environmental Assessment, on February 11, 1999 the FAA issued an Environmental Finding Document that found licensing the proposed launch activities was not a major Federal action that would significantly affect the quality of the human environment within the meaning of Executive Order (E.O.) 12114, the FAA's application of which was guided by the National Environmental Policy Act (NEPA). Accordingly, Sea Launch proceeded with two successful launches.

Sea Launch is currently proposing a third launch from the same launch location in the east-central Pacific using a different flight plan involving a southeasterly, non-equatorial launch azimuth to transport a payload into medium earth orbit (MEO). The proposed third launch will use the same type of payload, launch vehicle, launch site and primarily traverse international waters with the stage 1, stage 2 and payload fairing impact zones all located in international waters. Similar to the first two launches which approached Wolf and Darwin Islands of the Galapagos Island Group, the third launch flight plan approaches but does not traverse uninhabited Ducie Island of the Pitcairn Island group. The chance of any environmental impact from failed mission scenarios associated with the change in launch azimuth is extremely small, similar to the scenarios evaluated in the earlier Environmental Assessment (EA), dated February 11, 1999.

In a normal launch scenario, the risk of any stage or fairing impacts remains very low, even though the proposed southeasterly launch azimuth will take the launch vehicle in the vicinity of French Polynesia and the Pitcairn Island group for approximately three minutes. These impact risks are similar to the February 11, 1999 EA scenarios.

Based on a review of the previous Environmental Assessment and the subsequent Written Reevaluation of the Sea Launch Environmental Assessment with Respect to a Proposed Non-Equatorial Launch Azimuth Scenario for the Sea Launch Limited Partnership, it is concluded that licensing the new southeasterly launch azimuth would not create any new environmental impacts. The environmental impacts of the proposed southeasterly launch azimuth are equivalent to those associated with the equatorial launch azimuth used for the geosynchronous transfer orbit launches previously licensed by the FAA. The

environmental impacts of the southeasterly launch azimuth are likewise expected to be insignificant. This review concludes that the change in launch azimuth does not controvert the conclusions of the previous study and there are no substantive changes to environmental impacts or mitigation measures as described in the Environmental Assessment.

Based on this review and consistent with FAA Order 1050.4D, paragraph 92, the FAA has concluded that the proposed change to a non-equatorial launch azimuth for the third launch conforms to the previously approved Environmental Finding Document and final Environmental Assessment, that the data in that Environmental Assessment and Environmental Finding Document are still valid and that all pertinent conditions and requirements of the prior approval have been met or will be met in the current action.

After careful and thorough consideration of the facts, the undersigned finds that the proposed change in launch azimuth is consistent with the purpose of the national environmental policies and objectives as set forth in E.O. 12119 the FAA's application of which is guided by NEPA, and that the proposed change will not significantly affect the quality of the human environment or otherwise include any condition requiring additional consultation. These findings are made pursuant to FAA commercial space launch licensing authority in 49 USC Subtitle IXch. 701, Commercial Space Launch Activities, §§ 70101-70121 and implementing regulations and guidance.

Ron Gress

_____ _____

Manager, Licensing and Safety Division
Associate Administrator for
Commercial Space Transportation

Date

SUBJECT: Written Reevaluation of the Sea Launch Environmental Assessment with Respect to a Proposed Equatorial Launch 83.43°Azimuth Scenario for the Sea Launch Company

DATE: **DRAFT:** April 27, 2000

INTRODUCTION AND BACKGROUND

Sea Launch Limited Partnership (SLLP) is an international commercial venture formed to conduct commercial space launch operations from a mobile, floating launch platform in international waters in the east-central equatorial Pacific Ocean. The Commercial Space Launch Act (CSLA) of 1984 (Public Law 98-575), as amended 49 U.S.C. §§ 70101-70119, authorizes the U.S. Secretary of Transportation to oversee and coordinate U.S. commercial launch operations and to issue licenses authorizing commercial launches and the operation of commercial launch sites. The Secretary is implementing this authority through the Federal Aviation Administration (FAA) Associate Administrator for Commercial Space Transportation (AST). FAA exercises its licensing authority in accordance with the CSLA and Commercial Space Transportation Licensing Regulations (14 CFR Ch. III), which authorize the FAA to license the launch of a launch vehicle when conducted within the U.S. and those operated by U.S. citizens abroad. SLLP is a foreign entity controlled by a U.S. citizen. Licensing a launch is a Federal action requiring environmental analysis by the FAA in accordance with Executive Order 12114, the application of which is guided by the National Environmental Policy Act (NEPA) of 1969.

The FAA prepared a Final Environmental Assessment (EA) for the Sea Launch Limited Partnership Project (prepared for the Department of Transportation, FAA Office of the Associate Administrator for Commercial Space Transportation, by ICF Consulting Group and SLLP) which was signed and issued by the FAA on February 11, 1999. The Final EA assessed the proposed actions of constructing, operating and licensing launches of the Zenit-3SL from a mobile, floating launch platform in international waters in the east-central equatorial Pacific Ocean. An Environmental Finding Document, which is the equivalent of a Finding of No Significant Impact (FONSI) pursuant to the National Environmental Policy Act of 1969, was issued on February 11, 1999, after the FAA reviewed and analyzed the available data and information on existing conditions, potential project impacts on the human environment, and measures to mitigate potential impacts. The FAA concluded that licensing the operation of the proposed launch activities was not a major Federal action that would significantly affect the quality of the human environment within the meaning of Executive Order 12114 and the National Environmental Policy Act (NEPA) of 1969. Therefore the preparation of an Environmental Impact Statement (EIS) was not required. The proposed action as set forth in the Final EA included three launches for the first year of operation and six launches for each subsequent year.

As of this date, Sea Launch has launched three Zenit-3SL rockets. The first two launches used an azimuth of 88.67° while the third employed an azimuth of approximately 135°. An Environmental Finding Document related to a Written Reevaluation of the Sea Launch Environmental Assessment addressing this third launch was signed on February 25, 2000. Sea

Launch is currently proposing to launch from the same location in the east-central Pacific using a slightly different flight plan.

Sea Launch Company's application for a FAA launch license for Mission 5 calls for a equatorial launch with an azimuth of 83.43° to transport a payload into geosynchronous transfer orbit (GTO). The data and analyses contained in the February 11, 1999, Environmental Finding Document are still substantially valid and all pertinent conditions and requirements of the prior approval have or will be met in the current action. The environmental aspects of Mission 5 are essentially equivalent to the original equatorial launch azimuth (i.e., 88.67°) launches licensed by FAA for Missions 1 and 2—and Mission 4 which is pending. (Mission 3 employed an azimuth of approximately 135°). Mission 5 would utilize the same type of payload, launch vehicle, launch site, and deep and open ocean environments for the Stage 1, Stage 2, and payload fairing impact zones. As is the case with Missions 1 and 2, the flight plan for Mission 5 presents no risk to any populated land mass until a brief (27 second) very high altitude (over 180 kilometers) Instanteous Impact Point (IIP) traverse of a portion of South America. Mission 5 is also similar to Missions 1 and 2 in that the flight plan approaches, but does not go directly over, an uninhabited island. For Missions 1 and 2 the flight plan approached the ecologically sensitive Wolf and Darwin Islands of the Galapágos Island group; in Mission 5 the flight plan approaches but does not go directly over Cocos Island (Costa Rica), an uninhabited island with a rich and nationally protected environmental system. Sea Launch has carefully selected the flight plan for Mission 5 to meet customer and safety requirements. The risks to human safety and very low probability of environmental degradation posed by Mission 5 are similar to Missions 1 and 2 and are within FAA standards and guidelines.

Missions 1 and 2	**Mission 5**
Payload, vehicle and launch site	**Payload, vehicle and launch site**
Payload: communications satellite	Payload: communications satellite
Zenit-3SL launch vehicle	Zenit-3SL launch vehicle
154°W, 0N° launch site	154°W, 0N° launch site
Launch azimuth 88.67°	Launch azimuth 83.43°
Stages 1 & 2 & Payload fairing impact zone	**Stages 1 & 2 & Payload fairing impact zone**
Deep and open ocean	Deep and open ocean
Limited vessel traffic	Limited vessel traffic
Low biological productivity	Low biological productivity
Overflight zone	**Overflight zone**
No overflight of populated islands in Pacific	No overflight of populated islands in Pacific
Near, but not over, Wolf & Darwin Islands	Near, but not over, Cocos Island
Short overflight of South America	Short overflight of South America
Risk to humans below FAA standard	Risk to humans below FAA standard

PROPOSED ACTION

A FAA conclusion approving this environmental analysis will support approval of a proposed change to Sea Launch operations for Mission 5. The proposed change is the addition of a different azimuth equatorial launch to transport payloads into GTO.

REEVALUATION OF ENVIRONMENTAL CONSIDERATIONS AND MITIGATION

The proposed Mission 5 will require a launch slightly north of east (i.e., 83.43°) to support the placement of a satellite in a slightly inclined GTO (see Figure 1). With the exception of this slightly inclined orbit, Sea Launch's Mission 5 operations will be substantially identical to those addressed in the EA for the Sea Launch Project. The predicted environmental effects of Mission 5 (i.e. stage and fairing impact) will occur in a similar but not identical location as with Missions 1 and 2; therefore, the data and analyses contained in the February 23, 1999, Environmental Finding Document are still substantially valid and all pertinent conditions and requirements of the prior approval have or will be met in the current action. (The failed mission scenario is described in detail on page 11.)

The Mission 5 flight travels over water that ranges from 1,500 to 4,500 meters deep, except in the area of Cocos Island where the water remains deep to within a few kilometers of the island itself, and the transit of South America. The ocean areas traversed can be considered predominantly open ocean.

The risks to human safety and probability of environmental impact discussed in the EA for Missions 1 and 2 are comparable to those posed by Mission 5. In addition, the risks and probability of impact are within FAA standards and guidelines.

The Zenit-3SL launch vehicle described in the EA is the same one proposed for use for Mission 5, and the elements of the Mission 5 payload are addressed in the EA. Appendix A of the EA describes the processing of the payload and fueling prior to mating to the launch vehicle. The Mission 5 payload uses a propulsion system of Anhydrous Hydrazine fuel (max. of 826 kg.) and N_2O_4 (max. of 1,348 kg.). Several small-scale explosive devices incorporated in the payload are used to activate valves, separation devices, and other similar hardware components. The following materials used in the Mission 5 payload construction are typical of those used in spacecraft construction.

- Aluminum
- Aluminum Honeycomb
- Graphite/Epoxy
- Steel
- Titanium

As with the earlier missions, there are no radioactive materials or emission sources on Mission 5. There is non-ionizing radiation associated with the Mission 5 payload from the Ku- and C-band payload and the Telemetry Tracking Command and Ranging (TTC&R) subsystem.

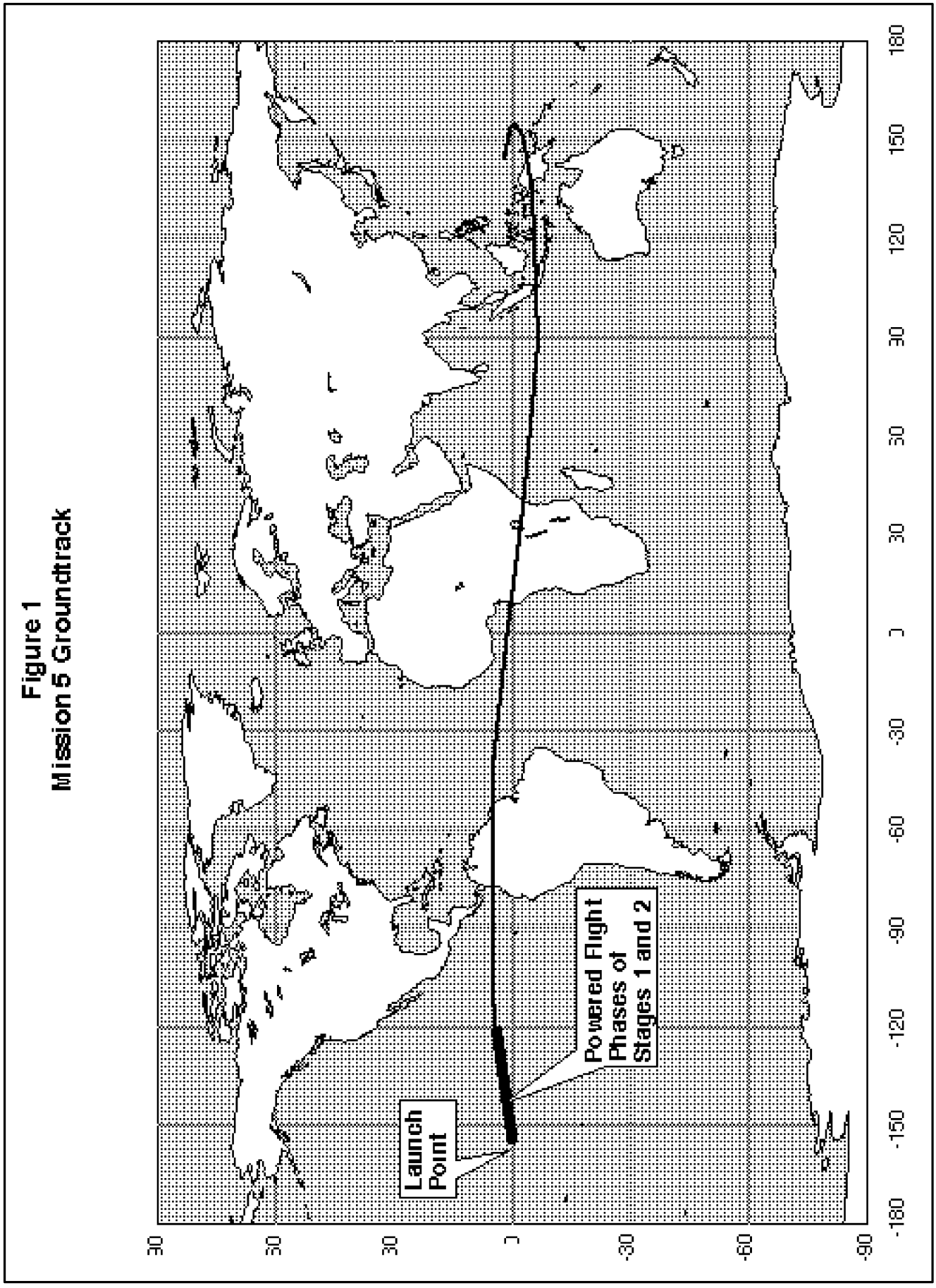


Figure 1
Mission 5 Groundtrack

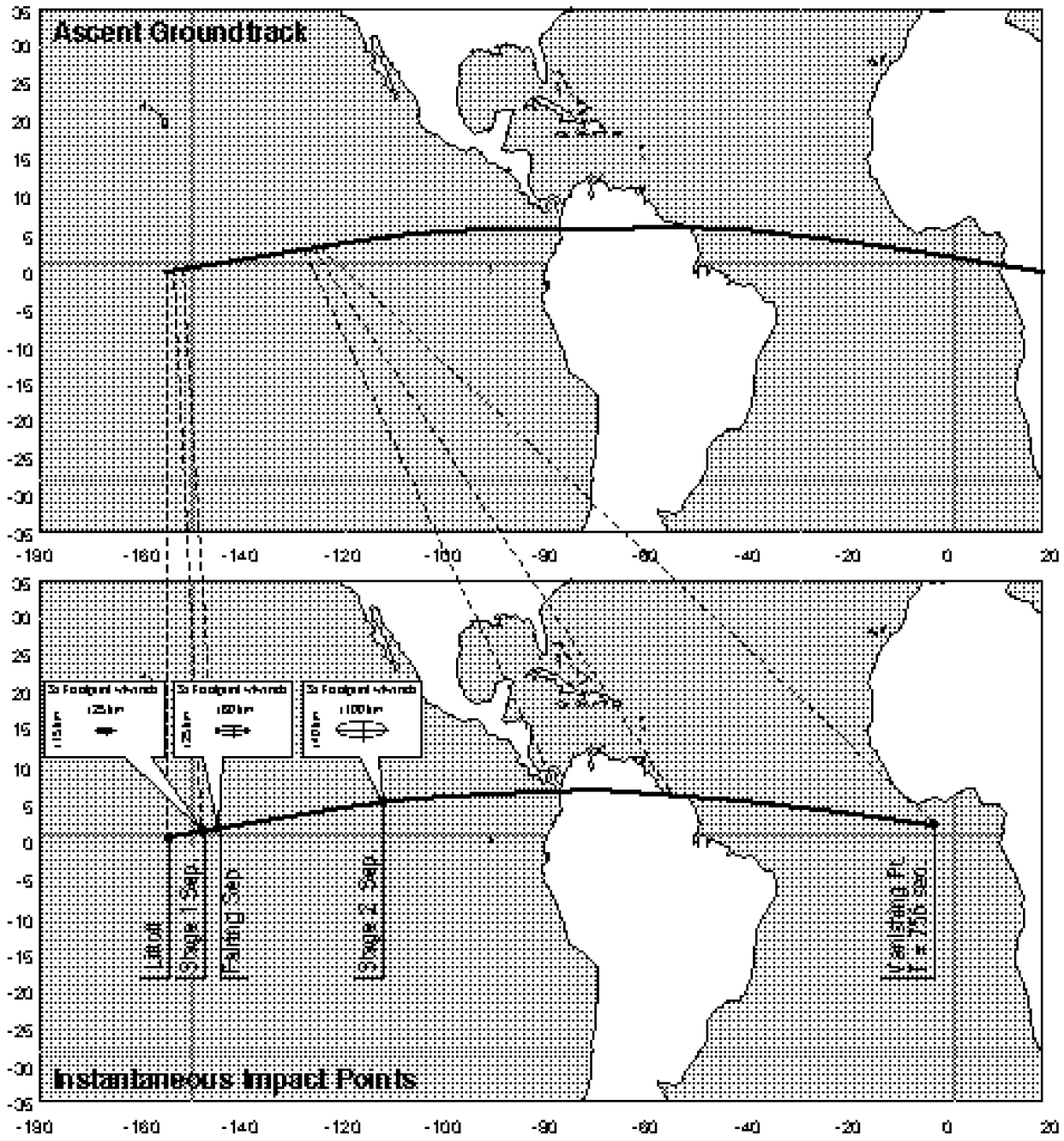
These sources present no radiation concerns that would require additional safeguards other than those already discussed in the EA for health and safety issues. There are no unique exhaust products associated with the Zenit-3SL Mission 5 launch vehicle that are not addressed in the EA.

AFFECTED ENVIRONMENT

First stage flight of Mission 5 will begin in international waters at 154° W on the equator, transit over international waters, and terminate following Stage 1 separation over international waters at approximately 0.83° N and 147.02° W (see figure 2). The payload fairing separates and impacts in international waters at approximately 1.04° N and 145.26° W. The second stage separates and impacts in international waters at approximately 4.29° N and 114.56° W. The impacts in international waters corresponding to the separation of the first and second stages and payload fairing occur outside the area covered by the Convention for the Protection of the Natural Resources and Environment of the South Pacific Region. Under normal operational conditions, any impacts from the stages are expected to occur outside any 200-nautical mile exclusive economic zone. The third stage will begin powered flight over international waters, and propel the third stage and satellite payload toward South America. The Block DM-SL upper stage and payload fly over a slightly north of equatorial region of South America with an IIP transit time of 27 seconds.

A review of a sea lane chart would suggest that the frequency of potentially affected vessel traffic for Mission 5 may be slightly higher than was the case for Missions 1 and 2. The groundtrack for Mission 5 as it approaches the coast of South America is slightly north of east (i.e., approximately 6° N rather than 1° N) and would bring the overflight closer to the Pacific end of the Panama Canal and its traffic separation lanes. Consequently, any canal traffic on the day of the launch exiting the Pacific end of the canal and heading below the equator as well as any traffic leaving South American ports and heading toward the Pacific end of the canal could theoretically cross under the overflight area. It would be impossible to quantify this potential traffic with any precision, however, on a typical day, Panama Canal traffic averages 40 oceangoing transits (this was the monthly average for March 2000, with a daily high of 48 and daily low of 34) It is reasonable to assume that less than half of this traffic would be potentially affected by crossing under the overflight area.

Figure 2
Mission 5 Stage Separation



The precise area of interest under the failed mission scenario—the Impact Limit Lines (ILL)—is a near-rectangular band in which the centerline is the Stage 3 groundtrack (IIP) from approximately 87.5° W and 87° W. The long sides of the ILL are approximately 125 km apart, and are centered on the IPP at approximately 5.9° N during this section (see Figure 3).

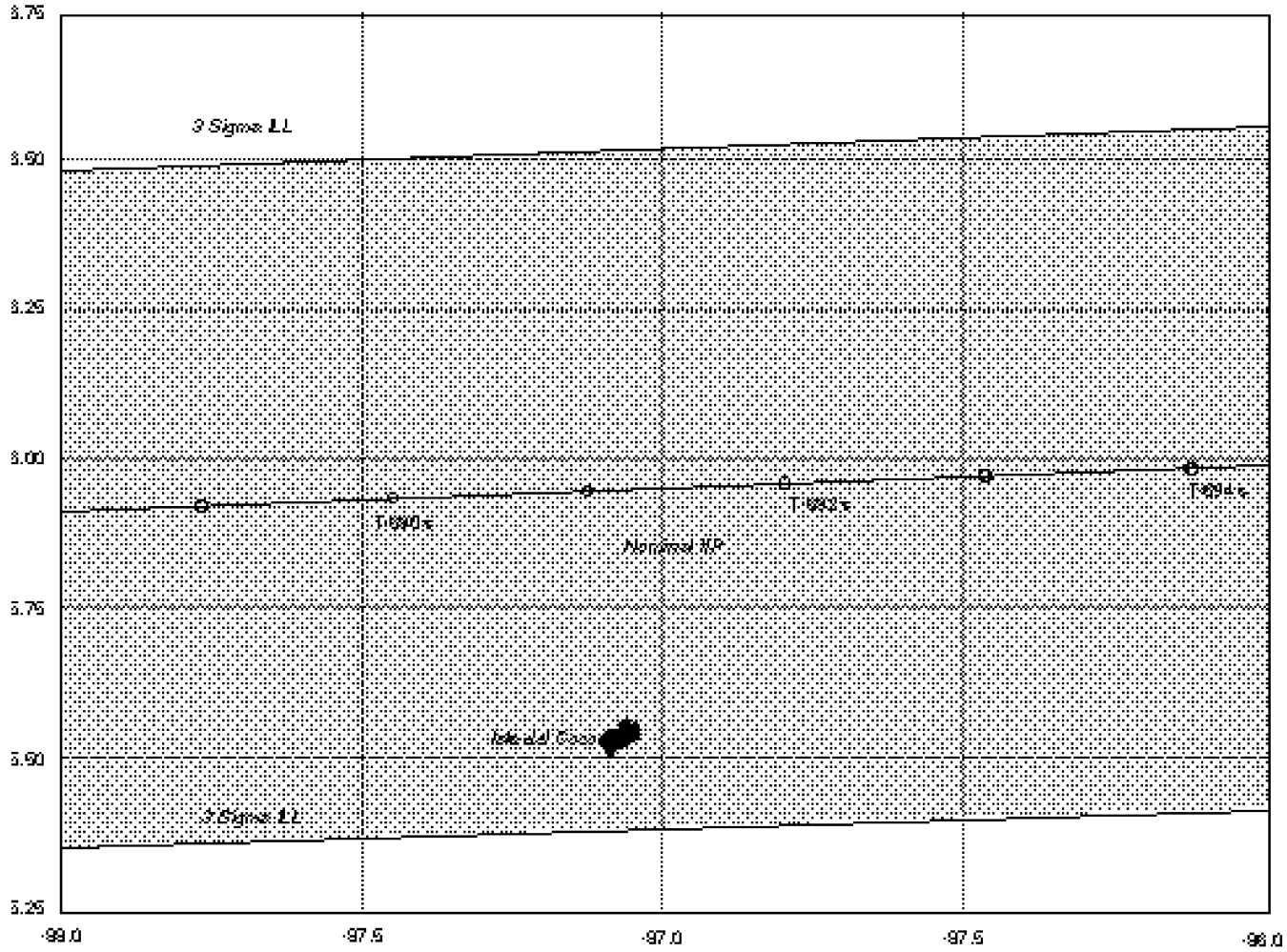
The ILL is a statistical concept. It defines the area where the probability of an effect is within the 3-sigma (or three standard deviation) boundary. That is, if an effect is to occur—in this case, debris falling associated with a failed mission—the degree of certainty that the effect would take place within the area defined by the ILL is 99.74%; alternatively, the chance that the effect would take place outside the area would be 0.26%, or roughly 1 in 400. It is important to remember that the risk of the effect happening outside the ILL must incorporate both the 3-sigma boundary as well as the estimated chance of the failed mission scenario; consequently, the risk of debris falling outside the ILL would be 0.01%. For normal operations, the area defined within the ILL will be unaffected by the vehicle passing overhead, since the planned return-to-earth of Stages 1 and 2 and the Payload Fairing occur well before the overflight of this area, respectively, in international waters.

One island, Isla del Coco or Cocos Island, while not directly under the overflight area is within the boundaries of the ILL for the failed mission scenario (e.g., the 3-sigma lateral dispersion envelope). Cocos Island, located at 5.55° N and 87.00° W, is situated in the Pacific Ocean 532 km from Cabo Blanco in Costa Rica. The Island is a National Park, created by Executive Decree No. 8748-A of Costa Rica, on June 22, 1978, and added to the UNESCO World Heritage List on December 4, 1997. The island comprises 2,400 hectares and is uninhabited except for 5-15 park rangers who reside there for short periods of time, ensuring coverage so that there is always a presence on the island. Visitor to the island (mainly divers who have specifically traveled to the area) are allowed on the island for day hikes but not for overnight stays.

The description of the island's natural history varies considerably depending on the source. According to the UN System-Wide Earthwatch Web Site Island Directory, Cocos Island has only two reptilian/amphibian species that are endemic to the island, but are not threatened.

According to information from a Geocities web site, Cocos Island is the only island in the eastern Pacific with a humid tropical forest. The underwater portion of the national park attracts large pelagic species such as sharks, rays, tuna and dolphins, and has developed into a remote but frequented site for SCUBA divers. The island is volcanic in origin and is bounded by steep cliffs. Only two bays suitable for anchorage are to be found, on the northern end of the island. The cliffs are nesting areas for marine birds such as Boobies, Seagulls, and Noddies. The origin of the island's fauna is mainly eastern Pacific, Galapágos, and Central American mainland, but several groups, including some corals, are of Indo-Pacific origin. At least 60 species of animals are endemic to the island, several of which (although none are specified) are on the endangered species list. Fifty-nine species of fish, 97 mollusks, 57 crustaceans, 2 lizards and 7 land birds have been reported. The island has seventy-four species of birds, including three that are endemic (the Cocos Island Flycatcher, the Cocos Island Finch, and the Cocos

Figure 3
Impact Limit Lines in the Vicinity of Cocos Island (Mission 5)



Island Cuckoo. The flora of the island consists of 155 vascular and 48 nonvascular plants, of which about 15 percent are endemic.

According to the Costa Rican National Park web site, there are 235 species of plants (70 of which are endemic); 362 of insects (64 endemic); 2 reptilian species (i.e., lizard and salamander) both of which are endemic; 3 species of spiders; and 85 species of birds, including 4 endemic species; 57 crustacean; 118 aquatic mollusks; and more than 200 fish.

Despite the differing information, it can be concluded that Cocos Island is rich in plant and animal life, and the legal status and preserved nature of the national park has maintained a relatively undisturbed environmental setting on the island.

ENVIRONMENTAL IMPACTS

Air Quality and Atmospheric Emissions

The proposed change will not create a new impact on air quality or atmospheric emissions. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Water Quality

The proposed change will not create a new impact on water quality. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Noise

The proposed change will not create a new impact on noise. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Waste

The proposed change will not create a new impact on waste generation and management. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Biological and Ecological Impacts

The proposed change will not create a new impact related to biological or ecological activity. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Social and Economic Considerations

The proposed change will not create a new impact related to social or economic considerations. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document. In addition, because of the change in flight plan, the list of recipients of "notification of mariners and other interested parties," as specified in Sea Launch's Environmental Monitoring and Protection Plan, will be evaluated and adjusted accordingly.

Health and Safety

The proposed change will not create a new impact in the area of health and safety. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Threatened and Endangered Species

The proposed change will not create a new impact regarding threatened or endangered species. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Archeological and Cultural Resources

The proposed change will not create a new impact in relation to archeological and cultural resources. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Home Port Activities

The proposed change will not affect Home Port activities.

Energy Outputs

The proposed change will not affect energy outputs. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Environmental Justice

The proposed change will not create a new impact concerning environmental justice. Impacts in this category and the corresponding mitigation program will be similar to those noted in the Final EA and the Environmental Finding Document.

Cumulative Impacts

The proposed change will not affect cumulative impacts. Cumulative impacts will be similar to those noted in the Final EA and the Environmental Finding Document.

Failed Mission Scenario

Under the failed mission scenario, the fifth mission's proximity to Cocos Island poses a risk event comparable to the proximity of Wolf and Darwin Islands of the Galapágos Island Group during equatorial launch missions such as in Missions 1 and 2. This latter case is described in Section 4.3 of the EA. A similar failure analysis relative to Cocos Island is provided below. The various hazard scenarios for this phase of the ascent trajectory and the theoretical casualty expectation confirm the very low risks expected from possible failures during this phase of flight.

The altitude of the vehicle will be over 180 kilometers when approaching Cocos Island. The fifth mission flight plan allows the ILL, but not the nominal groundtrack (or IIP), to traverse the island. During the transverse through the vicinity of Cocos Island, the Block DM-SL will be undergoing a steady engine burn and acceleration. Historical performance reliability of this stage during this time of flight, as demonstrated by performance in both Zenit-3SL and Proton vehicles, is better than 98 percent. On-board systems will have been active for over two minutes, and will have stabilized from their start-up phases. The potential for an equipment failure during the timeframe of concern (i.e., approximately 690 seconds after lift-off) therefore, is extremely small. The corresponding risk and potential scale of impact to the ecosystem and vessels in the area from such a failure are, therefore, also extremely small.

In the case of Cocos Island, the nominal IIP will laterally pass by—but not directly over—the island for a duration of less than 0.5 seconds, approximately 691 seconds after launch, at an speed of over 6,900 meters per second (28,000 kilometers per hour). As a statistical concept, the ILL boundary will encompass Cocos Island as the IIP traverses the ocean surface. Given the launch vehicle's speed and altitude, however, the probability is extremely small that failure would occur at the moment the IIP passes abeam or nearly abeam the island. This is during a time when the propulsion and control systems have been stable for several minutes and, therefore, are less susceptible to failure as mentioned above. Further, in the event of a failure during this moment in time, debris from the third stage of the launch vehicle will principally burn, fragment, and scatter as it returns to earth. Specifically, payload structures would immediately tumble and rupture; the fuel and propellants would disperse and immediately vaporize and burn; and virtually all of the hardware components would fragment into small pieces, most burning during re-entry. Debris which could potentially survive include batteries and bolts of extremely durable material (e.g., titanium). Although surviving debris will be hot following re-entry, the risk of fire resulting from debris should be minimal, especially considering the humid climate of the island (which experiences over 7,000 mm of rain annually) as well as the natural convective cooling as the relatively small pieces return to Earth.

Given the groundtrack IIP separation from the island, the probability that a surviving piece of the dispersed set of debris would strike Cocos Island or the shallow waters extending out

from the island proper is calculated to be less than 2.06×10^{-7}. This analysis for Cocos Island follows the same method and yields comparable results as the analysis documented for Wolf and Darwin Islands in EA Section 4.3.4.2 and EA Appendix E on Galapágos overflight risk.

CONCLUSIONS

Based on the above review and in conformity with FAA Order 1050.4D, paragraph 92, the FAA has concluded that the proposed change to a equatorial launch with an azimuth of 83.43° for Mission 5 Sea Launch operations conforms to the prior approved Environmental Finding Document and Final EA, that the data contained in the approved EA and Environmental Finding Document are still substantially valid, that there are no significant environmental changes, and that all pertinent conditions and requirements of the prior approval have been met or will be met in the current action.

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Department of Transportation, Federal Aviation Administration, Docket #29280, Environmental Finding Document; Agency: Federal Aviation Administration (FAA), DOT Action: Environmental Finding Document: Finding of No Significant Impacts; February 11, 1999.

Parque Nacional Isla del Coco at www.nacion.co.cr./netinc/costarica/parques/isla.del.coco.html as of 4/13/00.

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"Sea Launch Environmental Monitoring and Protection Plan," Revision No. 1, August 30, 1999.

U.K. Hydrographic Office, "The World Main Ocean Routes for Power Vessels," nautical chart, December 1973.

U.N. System-Wide Earthwatch Web Site, at www.unep.ch/islands/IWC.htm last updated on February 3, 1998.

Environmental Finding Document Finding of No Significant Impact

US DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Environmental Finding
Written Reevaluation of the Sea Launch Environmental Assessment with Respect to a Equatorial Launch 83.28° Azimuth Scenario for the Sea Launch Company

On February 11, 1999, the Federal Aviation Administration (FAA) accepted a Final Environmental Assessment evaluating proposed launch activities from a mobile, floating launch platform in international waters in the east-central equatorial Pacific Ocean by the Sea Launch Limited Partnership (Sea Launch). The covered actions as evaluated in that Environmental Assessment included six launches per year using an approximately equatorial launch azimuth. Based on the February 11, 1999 Environmental Assessment, the FAA issued an Environmental Finding Document. This Document found that licensing the proposed launch activities was not a major Federal action that would significantly affect the quality of the human environment within the meaning of Executive Order (E.O.) 12114, the FAA's application of which was guided by the National Environmental Policy Act (NEPA). On February 25, 2000 the FAA issued an Environmental Finding Document based on a Written Reevaluation that found that licensing a single launch at a 135° azimuth was not a major Federal action that would significantly affect the quality of the human environment within the meaning of E.O. 12114. Accordingly, Sea Launch proceeded with two successful equatorial launches and one mission failure (135° azimuth launch).[1]

Sea Launch is currently proposing a fifth mission launch from the same launch location in the east-central Pacific (i.e., 154° W on the equator) using a launch azimuth of 83.28° to transport a payload into geosynchronous transfer orbit (GTO). The fifth mission would use the same type of payload, launch vehicle, launch site and would primarily traverse international waters with the stage 1, stage 2 and payload fairing impact zones all located in international waters. Similar to the first and second missions, the flight plan for the fifth mission presents no risk to any populated land mass until a 27-second high altitude (over 180 kilometer) Instantaneous Impact Point (IIP) traverse of a portion of South America. For the first and second missions, as addressed in the Final Environmental Assessment, the IIP traverse of South America was 29 seconds and the population density in those areas was less than 5/km^2. For the fifth mission, the population density used in the calculation is 9.5/km^2 (10,000/km^2 for the city of Medellin, Colombia, and less than 6/km^2 for the rest of South America).

The fifth mission is also similar to the first and second missions in that the flight path approaches, but does not go directly over, an uninhabited island. In the fifth mission, the flight path approaches Cocos Island (Costa Rica), an uninhabited Island with a rich and nationally protected ecosystem.

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[1] The fourth mission used an 88.67° azimuth which is essentially equivalent to the original approximately equatorial launch azimuth launches licensed by FAA for the first and second missions.

In addition, shipping lanes associated with the Panama Canal could be potentially impacted by the fifth mission. A review of the sea lane charts should suggest that the frequency of the affected vessel traffic is the same as it was in the first and second missions. Cocos Island is well outside the expected area for all stage and fairing impact points. The chance of any environmental impact from failed mission scenarios associated with the change in launch azimuth is extremely small and is similar to the scenarios evaluated in the Final Environmental Assessment, dated February 11, 1999.

In a normal launch scenario, the risk of any stage or fairing impact remains very low, even though the proposed launch azimuth will take the launch vehicle in the vicinity of Cocos Island. These impact risks are similar to those assessed in the February 11, 1999 Environmental Assessment failed mission scenarios.

Based on a review of the previous Environmental Assessment and the subsequent Written Reevaluation, it is concluded that licensing the 83.28° launch azimuth would not create any significant environmental impacts. The environmental impacts of the proposed 83.28° launch azimuth are similar to those associated with the equatorial launch azimuth used for the GTO launches previously licensed by the FAA. This review concludes that the change in launch azimuth does not controvert the conclusions of the February 11, 1999 Environmental Assessment and there are no substantive changes to environmental impacts or mitigation measures as described in the document.

Based on this review and consistent with FAA Order 1050.1D, paragraph 92, the FAA has concluded that the proposed change to an 83.28° launch azimuth for the fifth mission conforms to the previously approved Environmental Finding Document and Final Environmental Assessment, that the data in that Environmental Assessment and Environmental Finding Document are still valid and that all pertinent conditions and requirements of the prior approval have been met or will be met in the current action.

After careful and thorough consideration of the facts, the undersigned finds that the proposed change in launch azimuth is consistent with the purpose of the national environmental policies and objectives as set forth in E.O. 12114 the FAA's application of which is guided by NEPA, and that the proposed change will not significantly affect the quality of the human environment or otherwise include any condition requiring additional consultation. These findings are made pursuant to FAA commercial space launch licensing authority in 49 USC Subtitle IX ch. 701, Commercial Space Launch Activities, §§ 70101-70121 and implementing regulations and guidance.

Ron Gress

_____

Manager, Licensing and Safety Division
Associate Administrator for
Commercial Space Transportation

_____

Date

_____

Location Signed

SUBJECT: Written Reevaluation of the Final Environmental Assessment for the Sea Launch Project dated February 11, 1999 with Respect to Substituting Russian UDMH/ N_2O_4 for MMH/ N_2O_4 as Block DM-SL Fuel/Oxidizer Combination for Mission 7.

DATE: April 12, 2001

INTRODUCTION AND BACKGROUND

Sea Launch Limited Partnership (SLLP) is an international commercial venture formed to conduct commercial space launches from a mobile, floating launch platform in international waters in the east-central equatorial Pacific Ocean. 49 U.S.C. §§ 70101-70119 (the Act) authorizes the U.S. Secretary of Transportation to oversee and coordinate U.S. commercial launches, and to issue licenses authorizing commercial launches and the operation of commercial launch sites. The Secretary executes this authority through the Federal Aviation Administration's (FAA) Associate Administrator for Commercial Space Transportation (AST). The FAA exercises its licensing authority in accordance with the Act and Commercial Space Transportation Licensing Regulations 14 CFR Parts 413 and 415. These regulations authorize the FAA to license the launch of a launch vehicle when conducted by U.S. citizens abroad. SLLP is a foreign entity that works through its General Partner, Sea Launch Company, L.L.C. Licensing a launch is a major federal action requiring environmental analysis by the FAA in accordance with the National Environmental Policy Act (NEPA) of 1969. Because the launch to be licensed by the FAA will take place outside the territorial boundaries of the United States, the FAA's review is guided by Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions."

The FAA issued a Final Environmental Assessment (EA) for the SLLP Project on February 11, 1999. The February 11, 1999 EA assessed the proposed actions of operating and licensing launches of the Zenit-3SL from a mobile, floating launch platform in international waters in the east-central equatorial Pacific Ocean. The February 11, 1999 EA analyzed potential impacts of up to six launches per year. The FAA reviewed and analyzed the available data and information on existing conditions, potential project impacts on the environment, as well as measures to mitigate potential impacts, and issued an Environmental Finding Document on February 11, 1999. This Finding Document is the equivalent of a Finding of No Significant Impact (FONSI) pursuant to NEPA. The FAA concluded that issuing licenses for launches within the parameters specified (e.g., launch vehicle, launch location, and payload type) was not a major federal action that would significantly affect the quality of the natural and human environment within the meaning of Executive Order 12114 and NEPA.

As of this date SLLP has launched six Zenit-3SL launch vehicles. The first two, the fourth, and the sixth launches used an azimuth of 88.67°, the third employed an azimuth of 135°, and the fifth employed an azimuth of 83.28º. An Environmental Finding Document addressing the third launch was signed on February 25, 2000, and an Environmental Finding document addressing the fifth launch was signed on October 16, 2000.

PROPOSED ACTION

Mission 7 will utilize the same launch vehicle, launch location, launch azimuth and payload type as analyzed in the February 1999 EA. However, SLLP proposes to use 7 to 13 gallons (26 to 48 liters) of unsymmetrical dimethylhydrazine (1,1-dimethylhydrazine or UDMH) fuel along with nitrogen tetroxide (N_2O_4) oxidizer, imported from Russia as the propellants for the Upper Stage during Mission 7. These Upper Stage propellants would be a substitute for the 7 to 13 gallons (26 to 48 liters) of monomethylhydrazine (MMH) and the U.S. Grade N_2O_4 used for all previous missions. Thus, the proposed Federal action is to issue a launch specific license for the launch of an SLLP Zenit-3SL launch vehicle where the only modification to the mission description is a change in the Upper Stage propellants (Mission 7). Using Russian UDMH would provide a higher specific impulse than using MMH and thus offer an advantage for the commercial customer. This advantage consists of more efficient Upper Stage engine performance with higher engine reliability leading to improved mission safety and mission success. In conjunction with the change in fuel, SLLP intends to substitute, consistent grades of propellants in the Upper Stage, that is Russian Grade N_2O_4 with the Russian-produced UDMH to ensure proper, effective and safe functioning of the Upper Stage propellant.

REEVALUATION OF ENVIRONMENTAL CONSIDERATIONS AND MITIGATION

The only proposed change to the Mission 7 launch parameters when compared to the launch parameters (i.e., launch vehicle, launch location, flight track and payload type) analyzed in the February 11, 1999 Environmental Assessment is the proposed change in Upper Stage propellants. As indicated above, SLLP proposes to use 7 to 13 gallons (26 to 48 liters) of unsymmetrical dimethylhydrazine (1,1-dimethylhydrazine or UDMH) along with nitrogen tetroxide (N_2O_4) oxidizer, imported from Russia as the fuel for the Upper Stage during Mission 7. UDMH and MMH are both hydrazine fuels (a type of launch vehicle and spacecraft fuel used in hypergolic propellant systems[1]) that have different chemical and physical parameters (e.g., boiling point, specific gravity, vapor pressure, flash point). The two fuels, however, are similar in terms of their reactivity, products of combustion (based on N_2O_4 as an oxidizer), exposure limits, and United Nations (UN) and United States Department of Transportation (USDOT) hazard classification Consequently, the procedures employed for handling UDMH and MMH at Home Port and on board the Launch Platform would be the same as those described in detail in the February 11, 1999 EA. With the exception of the labeling of containers and the installation of UDMH-specific scrubber filters, all other handling procedures and processes will be identical to those handling procedures and processes for MMH, used in the previous missions. The combustion emissions of the two fuels will be similar and will occur at the same altitudes
(180 kilometers), well above the Earth's atmosphere, as described in the February 11, 1999 EA. There will be a variation in the stoichiometric ratios—i.e., the quantitative relationship of fuel and oxidizer in a hyperbolic reaction. In this instance the stoichiometric ratio refers to the quantity of MMH versus that of UDMH, required to react completely with a given quantity of N_2O_4 oxidizer.

The two different grades of N_2O_4 are similar in physical and chemical properties; there are however, some differences in the types and level of impurities.

[1] Hypergolic propellant systems use fuel and oxidizer combinations that self-ignite when mixed together without the aid of a spark or other external energy input to initiate the combustion reaction

The handling, storage, and transportation of the two materials will be identical. As oxidizers for the combustion of UDMH or MMH, the two grades will be identical and their effects will occur at the same altitudes (180 kilometers) well above the Earth's atmosphere as described in the February 11, 1999 EA.

The use of UDMH during activities at SLLP Home Port will require SLLP to modify Federal, state and local regulatory documentation prior to UDMH arrival on-site. The following documents will be amended prior to UDMH arrival on-site:

a) Hazardous Material Inventory, Emergency Planning and Community Right to Know Act (EPCRA) Long Beach Department of Health (CUPA)

b) Business Emergency Plan, Long Beach Fire Department

c) Operations Manual for the Transfer of Hazardous Material in Bulk, United States Coast Guard (USCG) Integrated Contingency Plan, Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), California OSHA, California Offshore Emergency Service (COES), United States Coast Guard

The following document which will be published in 2002, will reflect emission changes occurring in 2001.

d) Annual Emissions Inventory (Year 2001), South Coast Air Quality Management District (SCAQMD)

The following document will <u>not</u> require changes because regulated thresholds are not exceeded:

e) Risk Management Plan, Long Beach Department of Health, Certified Unified Program Agency (CUPA)

Scrubbers[2] are the components of scrubber filters specifically designed and constructed to capture and neutralize UDMH vapors. These filters have been delivered to SLLP and will be installed in the designated spaces. SLLP will not use UDMH at the Home Port until all Federal , state and local permit requirements have been met and all required safety equipment, including the scrubber filter elements, have been installed. Substituting Russian Grade N_2O_4 for U.S. Grade N_2O_4 will not affect Home Port activities or permitting.

The use of MMH in conjunction with N_2O_4 was evaluated in the February 11, 1999 EA and is used as a reference for comparison. A summary of the chemical, physical, and safety parameters of both U.S. and Russian Grade UDMH are compared with those of MMH in Table 1. Table 2 compares both U.S. and Russian Grade N_2O_4.

[2] A scrubber is an air pollution control device for removing impurities from a gas steam. Toxic constituents of the vapor are absorbed into and react with the "scrubber liquor" on the material in the scrubber tower.

Table 1: Summary of Chemical/Physical and Safety Parameters for UDMH and MMH

	MMH	UDMH (U.S. Grade)	UDMH (Russian Grade)
General Information			
Name	Monomethylhydrazine	1,1-Dimethylhydrazine	1,1-Dimethylhydrazine
Chemical formula	CH_3NHNH_2	$(CH_3)_2NNH_2$	$(CH_3)_2NNH_2$
Molecular weight	46.07	60.10	60.10
CAS:	60-34-4	57-14-7	no information
Composition	Methylhydrazine: 95 to 99% Water: 1 to 5%	1,1-dimethylhydrazine: 95 to 99% Dimethyl amine: 1 to 5% Water: 0.1 to 1%	1,1-dimethylhydrazine: 98.6% Dimethyl amine: 0.5% Methyl alcohol: 0.4% Water: 0.5%
Chemical/Physical Characteristics			
Boiling point	87.5°C	63°C	63°C
Melting Point	-52.4°C	-58°C	-57°C
Vapor Pressure	49.6 mm Hg (at 25°C)	157 mm Hg (at 25°C)	no information
Vapor Density (air = 1)	1.59	2.07	no information
Specific Gravity	0.874 (at 25°C)	0.80 (at 20°C)	0.790 (at 20°C)
Flash point	21°C (COC method)	-15°C (COC)	-18°C (Abel)
Solubility in Water	miscible	miscible	soluble
Appearance	clear, colorless liquid with amine odor	clear, colorless liquid with ammonia odor	colorless or light yellow fuming in the air high-toxic liquid with ammonia odor
Handling & Safety Information			
Reactivity	stable, avoid: temperatures greater than 88°C, static discharge, direct sunlight, heat, sparks strong oxidizers	stable, avoid: heat, sparks, open flame, strong oxidizers	explosive, highly inflammable liquid; easily oxidizes
Decomposition/ Combustion products	carbon oxides, nitrogen oxides	carbon oxides, nitrogen oxides	soot, carbon oxides, nitrogen oxides
Hazard classification	classified as IB flammable liquid	classified as IB flammable liquid, corrosive	classified as extremely dangerous substances, Class 1 of danger by effect on organism [a/] (GOST 12.1.007-76)
Health Hazard Data			
Exposure limits and effects	OSHA Permissible Exposure Limit (PEL): 0.35mg/m^3 (skin) Oral LD_{50} (rat) 32 mg/kg; considered mutagenic but not carcinogenic	OSHA PEL: 1mg/m^3 (skin) Oral LD_{50} (rat) 122 mg/kg; not considered carcinogenic	Toxicity level (max. permissible) 0.1mg/m^3 in production rooms air; 0.001mg/m^3 in atmospheric air—maximum single and daily average

NOTE: a/ Class 1 GOST is the most dangerous.

Sources:

S. P. Korolev Rocket and Space Corporation Energia, *Certificate of Material Safety: Unsymmetrical dimethyl hydrazine*, Nov. 10, 2000.
NIOSH, *Pocket Guide to Chemical Hazards: Methyl hydrazine*, www.cdc.gov/niosh/npg/npgd0419.html as of Dec. 18, 2000.
NIOSH, *Pocket Guide to Chemical Hazards: 1-1 Dimethylhydrazine*, www.cdc.gov/niosh/npg/npgd0227.html as of Dec. 18, 2000.
NIOSH, *Manual of Analytical Methods (NMAM): 1-1Dimethylhydrazine, Method 3515,* Fourth Edition, Aug. 15, 1994.
NIOSH, *Manual of Analytical Methods (NMAM): Monomethylhydrazine, Method 3510,* Fourth Edition, Aug. 15, 1994.
Olin Corporation, *Material Safety Data Sheet: Unsymmetrical dimethylhydrazine,* http://msds.pdc.cornell.edu/msds/siri/msds/h/q197/q293.html, Dec. 18, 2000.Olin Corporation, *Material Safety Data Sheet: Monomethylhydrazine,* http://msds.pdc.cornell.edu/msds/siri/msds/h/q384/q195.html, Dec. 18, 2000.

Table 2: Summary of Chemical/Physical and Safety Parameters for N_2O_4

	N_2O_4 (U.S. Grade)	N_2O_4 (Russian Grade)
General Information		
Name	Nitrogen tetroxide	Nitrogen tetroxide
Chemical formula	N_2O_4	N_2O_4
Molecular weight	92.02	92.02
CAS:	10544-72-6	no information
Composition—	Nitrogen tetroxide: 97-97.5% Nitrogen monoxide: 2.5 to 3% Water: 0.17 % Chlorine: 0.04% Iron: 0.5 ppm Particulates: 10 mg/l	Nitrogen tetroxide: 98.2% Nitrogen monoxide: 0.8% Nitric acid: 1.0%
Chemical/Physical Characteristics		
Boiling point	21°C	20.3 to 21.1°C
Melting Point	-11.2°C	-11.3 to -11.9°C
Vapor Pressure	17.7 mm Hg (at 21°C)	no information
Vapor Density (air = 1)	1.56	no information
Specific Gravity	1.49	no information
Solubility in Water	Complete	soluble
Appearance--	greenish brown liquid with acidic odor	brown to green liquid
Handling & Safety Information		
Reactivity	stable, avoid moisture, bases, most metals and organics	stable for 5 years, provided storage conditions are adequate; is a strong oxidizer
Hazard classification	non-flammable liquid, code G7	classified as moderately hazardous material, Class 3 of danger by effect on organism [a/] (GOST 12.1.007-76)
Health Hazard Data		
Exposure limits and effects	OSHA PEL: 9 mg/m^3 (skin)	Toxicity level (max. permissible) 2.0 mg/m^3

NOTE: a/ Class 1 GOST is the most dangerous.

Sources:

S. P. Korolev Rocket and Space Corporation Energia, *Certificate of Material Safety: Nitrogen tetroxide*, Nov. 10, 2000.
NIOSH, *Pocket Guide to Chemical Hazards: Nitrogen dioxide, dinitrogen tetroxide, nitrogen peroxide*, www.cdc.gov/niosh/npg/npgd0454.html as of Mar. 21, 2001.
Vicksburg Chemical, *Material Safety Data Sheet: Nitrogen tetroxide,* http://msds.pdc.cornell.edu/msds/siri/msds/h/q302/q346.html, Mar. 20, 2001.

Affected Environment

The proposed action does not result in a change to the affected environment as described in Section 3.0 of the February 11, 1999 EA.

Environmental Impacts

Air Quality and Atmospheric Emissions

The proposed Federal action, to license the launch of an SLLP Zenit-3SL launch vehicle for Mission 7 where the only change to the mission description is a change in the Upper Stage propellants, will not create a new impact on air quality or atmospheric emissions. The Russian UDMH (fuel) in conjunction with the Russian Grade N_2O_4 (oxidizer) are expected to produce similar emissions during Upper Stage flight as those from the MMH/U.S Grade N_2O_4 propellants previously used. In addition, the proposed propellants will be used in the Upper Stage only and thus would produce emissions well above the Earth's atmosphere (180 km). Impacts in this category and the corresponding mitigation program will be the same as those noted in the February 11, 1999 Final EA and the Environmental Finding Document.

Water Quality

The proposed action will not create a new impact on water quality. Impacts in this category and the corresponding mitigation program will be the same as those noted in the Final EA and the Environmental Finding Document.

Noise

The proposed action will not create a new impact on noise. Impacts in this category and the corresponding mitigation program will be the same as those noted in the Final EA and the Environmental Finding Document.

Waste

The proposed action will not create a new impact on waste generation and management. Impacts in this category and the corresponding mitigation program will the same as those noted in the Final EA and the Environmental Finding Document.

Biological and Ecological Impacts

The proposed action will not create a new impact related to biological or ecological activity. Impacts in this category and the corresponding mitigation program will be the same as those noted in the Final EA and the Environmental Finding Document.

Social and Economic Considerations

The proposed action will not create a new impact related to social or economic considerations. Impacts in this category and the corresponding mitigation program will be the same as those noted in the Final EA and the Environmental Finding Document.

Health and Safety

The proposed action will not create a new impact in the area of health and safety. Impacts in this category and the corresponding mitigation program will be the same as those noted in the Final EA and the Environmental Finding Document.

Threatened and Endangered Species

The proposed action will not create a new impact regarding threatened or endangered species. Impacts in this category and the corresponding mitigation program will be the same as those noted in the Final EA and the Environmental Finding Document.

Archeological and Cultural Resources

The proposed action will not create a new impact in relation to archeological and cultural resources. Impacts in this category and the corresponding mitigation program will be the same as those noted in the Final EA and the Environmental Finding Document.

Energy Outputs

The proposed action will not affect energy outputs. Impacts in this category and the corresponding mitigation program will be to the same as those noted in the Final EA and the Environmental Finding Document.

Environmental Justice

The proposed action will not create a new impact concerning environmental justice. Impacts in this category and the corresponding mitigation program will be the same as those noted in the Final EA and the Environmental Finding Document.

Home Port Activities

The proposed action will not create a new impact resulting from Home Port activities as SLLP will modify and comply with all Federal, state and local permit requirements prior to UDMH arrival on-site. The following documents will be amended prior to UDMH arrival on-site:

a) Hazardous Material Inventory, Emergency Planning and Community Right to Know Act (EPCRA) Long Beach Department of Health, Certified Unified Program Agency (CUPA)

b) Business Emergency Plan, Long Beach Fire Department

c) Operations Manual for the Transfer of Hazardous Material in Bulk, United States Coast Guard (USCG)

d) Integrated Contingency Plan, Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), California OSHA, California Offshore Emergency Service (COES), United States Coast Guard

The following document which will be published in 2002, will reflect emission changes occurring in 2001

e) Annual Emissions Inventory (Year 2001), South Coast Air Quality Management District (SCAQMD)

The following document will not require changes because regulated thresholds are not exceeded:

f) Risk Management Plan, Long Beach Department of Health, , Certified Unified Program Agency (CUPA)**]**

Scrubbers are the components of scrubber filters specifically designed, and constructed to capture and neutralize vapors UDMH vapors. These filters have been delivered to SLLP and will be installed in the designated spaces. SLLP will not use UDMH at the Home Port until all Federal, state and local permit requirements have been met and all required safety equipment, including the scrubber filter elements, have been installed.

Substituting Russian Grade N_2O_4 for U.S. Grade N_2O_4 will not affect Home Port activities or permitting.

Cumulative Impacts

The proposed action will not affect or cause cumulative impacts. Cumulative impacts will be the same as those noted in the Final EA and the Environmental Finding Document.

Failed Mission Scenario

Failed mission scenarios for this Written Reevaluation include all failure scenarios considered in the February 11, 1999 EA (e.g., explosion on the Launch Platform, uncontrolled Upper Stage loss etc.). Slight differences in combustion emissions may occur due to the small differences in the types and levels of impurities in the U.S. versus the Russian Grade nitrogen tetroxide and the use of UDMH rather than MMH. However, due to the remote likelihood of a failure during Upper Stage flight and the very high altitude of the vehicle at this stage in the flight, no impacts to the environment are expected. In addition, for failures during earlier portions of the flight, any unreacted fuel or oxidizer is likely to be completely destroyed before reaching the ocean or land surface, due to the volatility of hypergolic propellants (i.e., upon release they react with the atmosphere and dissipate),

Conclusions

Based on the above review and in conformity with FAA Order 1050.1D, paragraph 92, the FAA has concluded that the proposed change to substitute Russian UDMH/ N_2O_4 for MMH/ N_2O_4 as a propellant in the Upper Stage for Mission 7 conforms to the prior approved Environmental Finding Document and Final EA dated February 11, 1999, that the data contained in the approved Final EA and Environmental Finding Document are still valid, that there are no significant environmental changes, and that all pertinent conditions and requirements of the prior approval have been met or will be met in the current action. For Home Port activities, SLLP will not use UDMH at the Home Port until SLLP has complied with all Federal , state and local permit requirements and has installed all required safety equipment, including the scrubber filter elements.

REFERENCES

NIOSH, *Manual of Analytical Methods (NMAM): 1-1Dimethylhydrazine, Method 3515,* Fourth Edition, Aug. 15, 1994.

NIOSH, *Manual of Analytical Methods (NMAM): Monomethylhydrazine, Method 3510,* Fourth Edition, Aug. 15, 1994.

NIOSH, *Pocket Guide to Chemical Hazards: 1-1 Dimethylhydrazine*, www.cdc.gov/niosh/npg/npgd0227.html as of Dec. 18, 2000.

NIOSH, *Pocket Guide to Chemical Hazards: Methyl hydrazine*, www.cdc.gov/niosh/npg/npgd0419.html as of Dec. 18, 2000.

NIOSH, *Pocket Guide to Chemical Hazards: Nitrogen dioxide, dinitrogen tetroxide, nitrogen peroxide*, www.cdc.gov/niosh/npg/npgd0454.html as of Mar. 21, 2001.

Olin Corporation, *Material Safety Data Sheet: Unsymmetrical dimethylhydrazine,* http://msds.pdc.cornell.edu/msds/siri/msds/h/q197/q293.html, Dec. 18, 2000.

Olin Corporation, *Material Safety Data Sheet: Monomethylhydrazine,* http://msds.pdc.cornell.edu/msds/siri/msds/h/q384/q195.html, Dec. 18, 2000.

S. P. Korolev Rocket and Space Corporation Energia, *Certificate of Material Safety: Nitrogen tetroxide*, Nov. 10, 2000.

S. P. Korolev Rocket and Space Corporation Energia, *Certificate of Material Safety: Unsymmetrical dimethyl hydrazine*, Nov. 10, 2000.

Vicksburg Chemical, *Material Safety Data Sheet: Nitrogen tetroxide,* http://msds.pdc.cornell.edu/msds/siri/msds/h/q302/q346.html, Mar. 20, 2001.

US DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Environmental Finding
Written Reevaluation of the Final Environmental Assessment for the Sea Launch Project dated February 11, 1999 with Respect to Substituting Russian UDMH/N_2O_4 for MMH/N_2O_4 as Upper Stage Fuel/Oxidizer Combination for Mission 7

On February 11, 1999, the Federal Aviation Administration (FAA) accepted a Final Environmental Assessment evaluating the proposed launches from a mobile, floating launch platform in international waters in the east-central equatorial Pacific Ocean by the Sea Launch Limited Partnership (SLLP). The covered actions as evaluated in that Environmental Assessment included six launches per year using an approximately equatorial launch azimuth. Based on the February 11, 1999 Final Environmental Assessment, the FAA issued an Environmental Finding Document. This Document found that licensing the proposed launches within the parameters analyzed was not a major federal action that would significantly affect the quality of the human environment within the meaning of Executive Order (E.O.) 12114, the FAA's application of which was guided by the National Environmental Policy Act (NEPA).

As of this date SLLP has launched six Zenit-3SL launch vehicles. The first two, the fourth, and the sixth launches used an azimuth of 88.67°, the third employed an azimuth of 135°, and the fifth employed an azimuth of 83.28°. An Environmental Finding Document addressing the third launch was signed on February 25, 2000, and an Environmental Finding document addressing the fifth launch was signed on October 16, 2000.

Mission 7 will entail the same launch vehicle, launch location, launch azimuth and payload type as analyzed in the February 1999 Final EA. However, for Mission 7, SLLP is proposing to use 7 to 13 gallons (26 to 48 liters) of unsymmetrical dimethylhydrazine (1,1-dimethylhydrazine or UDMH) fuel, along with nitrogen tetroxide (N_2O_4) (oxidizer) imported from Russia as propellants for the Upper Stage or Block DM-SL. These Upper Stage propellants would be a substitute for the 7 to 13 gallons (26 to 48 liters) of monomethylhydrazine (MMH) and the U.S. Grade N_2O_4 used in all previous missions. Thus, the proposed Federal action is to issue a launch specific license for the launch of an SLLP Zenit-3SL launch vehicle where the only modification to the mission description is a change in the Upper Stage propellant (Mission 7).

UDMH and MMH are both hydrazine fuels (a type of launch vehicle and spacecraft fuel used in hypergolic[1] propellant systems) that have different chemical and physical parameters (e.g., boiling point, specific gravity, vapor pressure, and flash point).

[1] Hypergolic propellant systems use fuel and oxidizer combinations that self-ignite when mixed together without the aid of a spark or other external energy input to initiate the combustion reaction.

The two fuels, however, are similar in terms of their reactivity, products of combustion (based on N_2O_4 as an oxidizer), exposure limits, and United Nations (UN) and United States Department of Transportation (USDOT) hazard classification. The N_2O_4 oxidizer imported from Russia is equivalent to the U.S. Grade used for previous missions with only slight differences in trace impurities. The procedures employed for handling UDMH and MMH at Home Port and onboard the Launch Platform would be the same as handling procedures employed for previous missions and described in detail in the February 1999 Final EA. The labeling of containers will vary based on relevant regulatory requirements. In addition, scrubber filters for UDMH will be installed at the appropriate facilities at Home Port

With regard to SLLP Home Port Activities, the substitution of Russian UDMH/ N_2O_4 for MMH/ N_2O_4 as Upper Stage Fuel /Oxidizer Combination for Mission 7 will necessitate that SLLP comply with all Federal, state and local permit requirements prior to UDMH arrival on-site. Substituting Russian Grade N_2O_4 for U.S. Grade N_2O_4 will not alter Home Port activities or permitting.

Based on a review of the February 1999 Final Environmental Assessment and the "Written Reevaluation of the Final Environmental Assessment for the Sea Launch Project dated February 11, 1999 with Respect to Substituting Russian UDMH/N_2O_4 for MMH/ N_2O_4 as Upper Stage Fuel/Oxidizer Combination for Mission 7", the FAA has determined that issuing a launch specific license for the launch of an SLLP Zenit-3SL launch vehicle where the only modification to the mission description is a change in the Upper Stage propellant (Mission 7), would not create any significant environmental impacts.

During the Mission 7 launch, the potential environmental impacts of the proposed substitution of Russian UDMH/ N_2O_4 for MMH/ N_2O_4 as Upper Stage Propellant/Oxidizer Combination are the same as those assessed for the GTO launches previously licensed by the FAA. For Home Port activities, UDMH will not be used until SLLP has complied with all Federal, state and local permit requirements and has installed all required safety equipment, including the scrubber filters.

Based on this review and consistent with FAA Order 1050.1D, paragraph 92, the FAA has concluded that the proposed substitution of propellants for Mission 7 conforms to the previously approved Environmental Finding Document and Final Environmental Assessment, that the data in that Environmental Assessment and Environmental Finding Document are still valid and that all pertinent conditions and requirements of the prior approval have been met or will be met in the current action.

After careful and thorough consideration of the facts, the undersigned finds that the proposed change in Upper Stage propellants for Mission 7 is consistent with the purpose of the national environmental policies and objectives as set forth in E.O. 12114, the FAA's application of which is guided by NEPA, and that the proposed change will not significantly affect the quality of the human environment or otherwise include any condition requiring additional consultation.

These findings are made pursuant to FAA commercial space launch licensing authority in 49 USC Subtitle IX ch. 701, Commercial Space Launch Activities, §§ 70101-70121 and implementing regulations and guidance.

Ron Gress

_____	_____
Manager, Licensing and Safety Division Associate Administrator for Commercial Space Transportation	Date _____ Location Signed

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