Airport Laser Holding Position Enhancement Project Plan

FAA BAA Contract: DTFA01-00-R-01BAA

Alaskan Region Runway Safety Program Office

October 10, 2002

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1.0 Introduction

The objective of this plan is to outline the program activities for a demonstration and validation of an Airport Laser Holding Position Enhancement to be tested as an enhancement for holding position surface markings on airports. Through a Broad Agency Announcement, Greatland Laser, LLC. was selected as the contractor to produce a laser illumination of holding positions demonstration under contract to the Federal Aviation Administration (FAA). The scope of the Airport Laser Holding Position Enhancement plan outlines the path for conducting the demonstration project on Ted Stevens Anchorage International Airport.

Historically, operations on airport surfaces are both efficient and safe, but surface operations do encounter risk through several avenues. The first area of risk is the human factors interpretation of audio commands matched to visual clues while performing surface navigation functions. Unlike the roadways that both airfield drivers and pilots are used to operating on, airport traffic surfaces lack specific definition in many cases due the large expanses of pavement required to maneuver heavy aircraft. The unrestricted 360 degree of travel and ability to "pause" during travel is also peculiar to airport navigation as opposed to streets. Once the movement area is reached, navigation becomes critical as control of vehicles and aircraft become dependent upon audio communication through Air Traffic Control for both route and pause points. The risk in surface operations sharply increases in the area of "holding positions" as aircraft and vehicles must pause if a runway is occupied, or cross and occupy the runway themselves. The decision to cross or pause surface traffic is an air traffic control initiative, however, in the majority of runway incursions, air crews or drivers have missed the decision point, much like a surface street driver missing a red light at an intersection. A large number of the runway incursion events occurred at holding positions for two reasons, either the operator misunderstood the Air Traffic Control instruction, or the operator missed the visual cues at the holding position and crossed the point in error. The laser enhancement of holding positions is directed at improving performance in the later category of error where a surface operator unknowingly crosses the point, however, the project could also deliver benefits in the first case through better visual cues that may cause a surface operator to question themselves as to whether they had received a clearance to cross the location.

The point of contact is Jim O'Meara (Greatland Laser, LLC.) and questions regarding this task and documentation may be directed to Jim O'Meara at (laser@alaska.net) or (907) 245-4475.

2.0 Stakeholders / Organizations

Greatland Laser, LLC. and Galaxy Scientific Corporation is responsible for developing the plan, coordinating and conducting the demonstration in accordance with the contract and through the FAA Contracting Officer, assisted by the COTR, and Ted Steven's Anchorage International Airport Operations Department. Other organizations either participating in the demonstration of the Airport Laser Holding Position Enhancement Project, contributing to the development, and to be coordinated with, include the Airlines that operate on Ted Stevens Anchorage International Airport, NATCA, FAA Airways Facilities, FAA NAS Implementation, and the State of Alaska Department of Transportation and Public Facilities.

Stakeholders include FAA Air Traffic Controllers who have a need to see whether an aircraft or vehicle is beyond the holding position, Airport Operations and Airport Vehicle Operators who have a need to be able to see the holding positions in all types of weather, and airport maintenance employees who would need to maintain the equipment that is installed by private contractors.

In its current design plan, the National Air Traffic Controller Association (NATCA) would not have a role in the operation or monitoring of the laser enhanced holding position marking, the marking would be operated in concert with airfield elevated runway guard lights, is not controlled, and is only an enhancement of existing marking.

3.0 Milestones and Activities

3.1 Activities

The goal of the Airport Laser Holding Position Enhancement Project program demonstration is to conclude with a report that will validate the use of laser enhancement for holding positions as an improvement to airport lighting systems and a tool which airport operators may use to decrease risk at holding positions. The new use of laser technology in incorporating visible spectrum bright light into surface marking requires a regimen of activities directed at equipment production, deployment and operation in a manner consistent with good experimentation and testing procedures. All activities required to achieve this goal are being planned and coordinated by Greatland Laser, LLC. in coordination with Ted Stevens International Airport and the FAA. Proposed Milestones and Activities for this effort are included in this section.

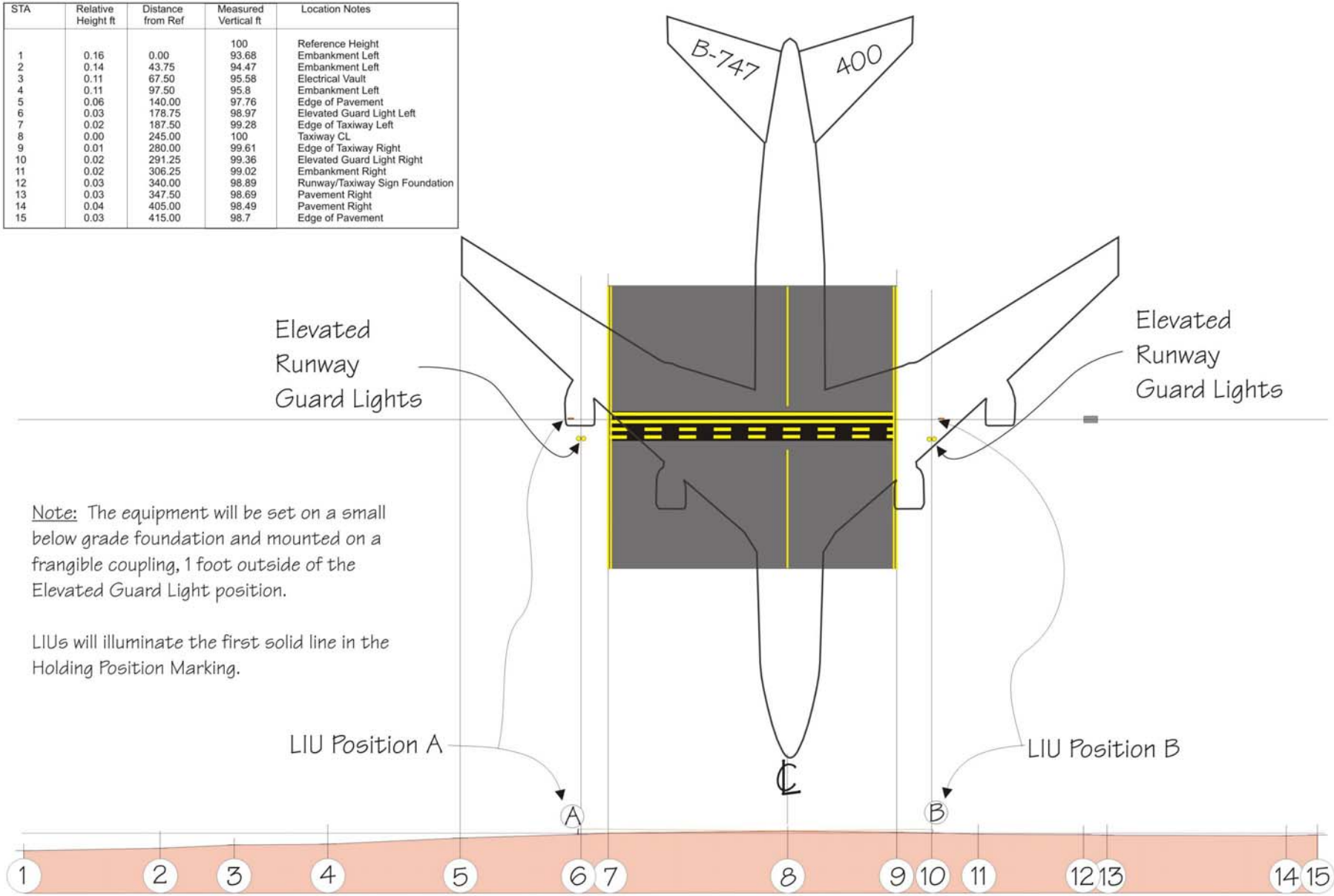
Milestones	Plan Date	Actual Date
Detailed Program Plan	**08/08/02**	**08/08/02**
Detailed LIU Design Plan	**09/05/02**	**09/05/02**
Monthly Status Update Telecon	**09/06/02**	**09/06/02**
Airport Location Survey	**10/02/02**	**10/02/02**
Detailed Demonstration Program	**10/03/02**	**10/03/02**
Monthly Status Update Telecon	**10/03/02**	**10/04/02**
Airport Specification Drawing	**10/08/02**	**10/09/02**
Airport Construction Survey	**10/21/02**	**10/11/02**
Monthly Status Update Telecon	**11/01/02**	
Delivery of Laser Unit	**11/01/02**	
Site Setup and Construction	**11/04/02**	**10/21/02**
Testing, Demonstration and Survey Start	**11/05/02**	
Testing and Demonstration Complete	**11/15/02**	
Monthly Status Update Telecon	**12/05/02**	
Final Program Report/Concept of Operations	**12/13/02**	
Closure Meeting	**12/13/02**	

The plan for operation is based upon a schedule that addresses input from the National Air Traffic Controllers Association, FAA Air Traffic Management, Regional Airline Pilots Association, the Operations Staff and Management at Ted Stevens Anchorage International Airport, the FAA Runway Safety Program, the equipment manufacturer Greatland Laser, and various other interested parties.

As per the contract, the equipment will illuminate a solid "yellow" line across a holding position line at least 75 feet wide. The holding position location to be illuminated was selected as an intersection of suggestions from NATCA, Air Traffic Management and Airport Operations. The holding position selected is the east side of Runway 14/32 at Taxiway Kilo (figure 3-1). The holding position is typical, the only notable challenge for aircraft at this point is the positive grade from the subject hold position to the runway edge. At times it may be distracting for pilots moving heavy loads over the asphaltic concrete pavement due to the break away thrust required to move the aircraft up the incline. This is principally a problem during the summer periods when the asphalt becomes softer and aircraft sink into the pavement when pausing during taxi, and should not be an issue during this demonstration.

The laser illuminating equipment will be mounted similar to the detail drawings in figure 3-2. The equipment weighs approximately 17 pounds and will be mounted on 2 inch electrical mechanic tubing (EMT) which will be frangibly mounted to a below surface foundation. The equipment is "fixed by function" as a lighting/marking aid requiring its location near the light line of the taxiway, and the equipment has been made frangible by its mount.

STA	Relative Height ft	Distance from Ref	Measured Vertical ft	Location Notes
			100	Reference Height
1	0.16	0.00	93.68	Embankment Left
2	0.14	43.75	94.47	Embankment Left
3	0.11	67.50	95.58	Electrical Vault
4	0.11	97.50	95.8	Embankment Left
5	0.06	140.00	97.76	Edge of Pavement
6	0.03	178.75	98.97	Elevated Guard Light Left
7	0.02	187.50	99.28	Edge of Taxiway Left
8	0.00	245.00	100	Taxiway CL
9	0.01	280.00	99.61	Edge of Taxiway Right
10	0.02	291.25	99.36	Elevated Guard Light Right
11	0.02	306.25	99.02	Embankment Right
12	0.03	340.00	98.89	Runway/Taxiway Sign Foundation
13	0.03	347.50	98.69	Pavement Right
14	0.04	405.00	98.49	Pavement Right
15	0.03	415.00	98.7	Edge of Pavement



Note: The equipment will be set on a small below grade foundation and mounted on a frangible coupling, 1 foot outside of the Elevated Guard Light position.

LIUs will illuminate the first solid line in the Holding Position Marking.

LIU A is approximately 68 feet left of Taxiway K Centerline with an equipment height of 2 feet above the ground
LIU B is approximately 48 feet right of Taxiway K Centerline with an equipment height of 2 feet above the ground
* at the approximate heights the light beam reaches a grazing angle to the pavement at approximately 1.75 feet

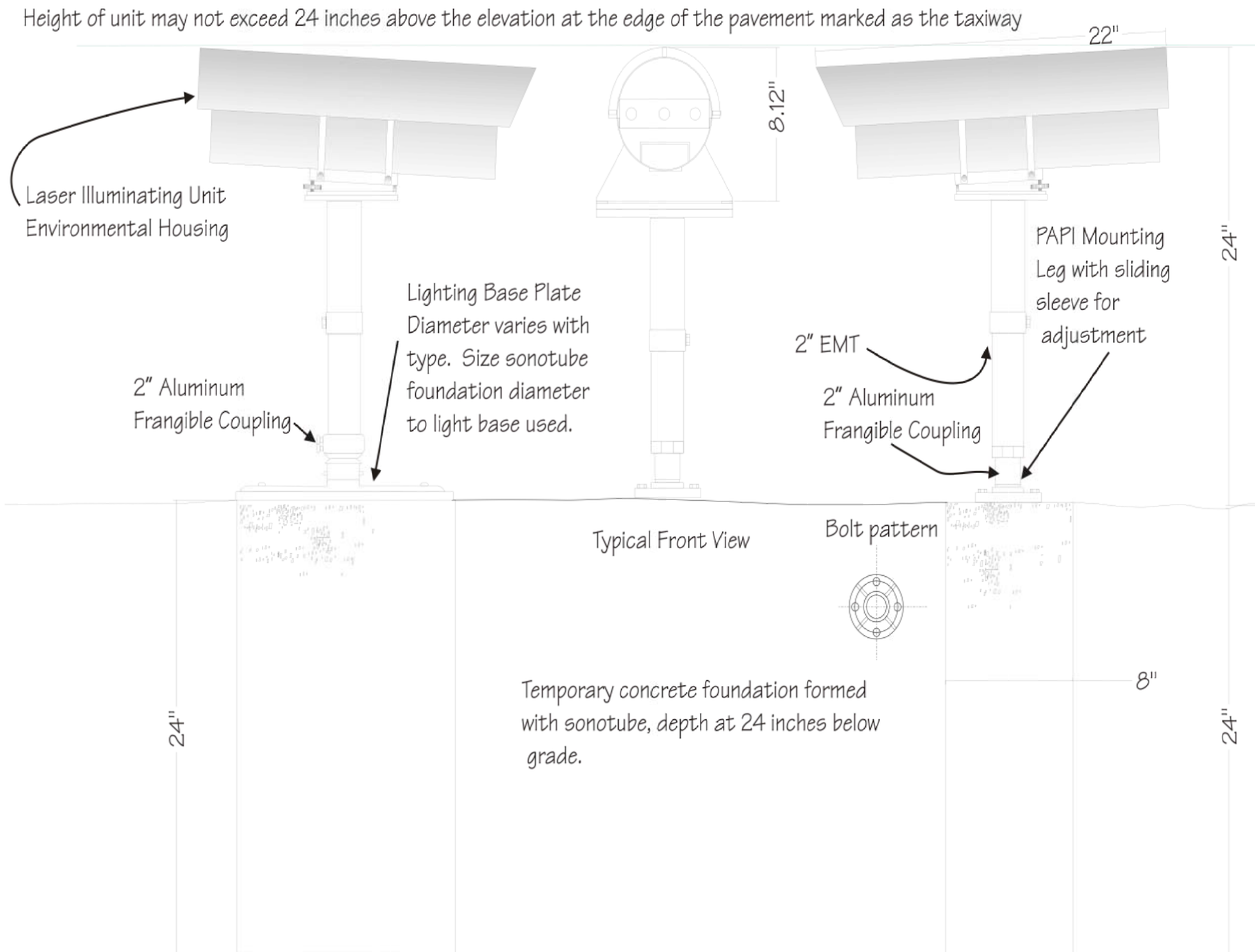
Scale: 1/4 inch = 10 feet

0 20 40 60 80 100 120 140

*Scaled to fit an 11 x 17 in page

RAM: 10/9/02

Fig 3-1
6



Typical Airfield Lighting Equipment Mounting Details

Two examples of mounting methods that meet the requirement for frangibility within the Object Free Zone/Obstacle Free Area
Typical weight of the Laser Illuminating Unit is 17 lb, concrete is 2,000 psi. Bolts are fastened to imbedded anchor sleeves.

Fig 3-2

The illumination and data collection-reduction schedule will be as follows:

Event	Date	Hours of Operation
LIU Foundation Installation	**10/21**	**0830 - 1000**
Printing and distribution of User Survey packages	**10/31-11/15**	**0800 - 1700**
LIU Test and setup start initial test	**11/04**	**1400 - 2200**
Yellow Laser Holding Position Marking Demonstration at Taxiway K	**11/05-13**	**1400 - 2200**
FAA Tech Center Boeing 727 Observation Platform	**11/13-14**	**1600 - 2130**
Red Laser Holding Position Bench Marking Demonstration on North Ramp taxiway	**11/15**	**0400 -1400**
Data reduction	**11/25-29**	**0700-1700**

3.2 Technology Review

A technology review will be conducted in an effort to define a Airport Laser Holding Position Lighting System. The technology review undertaken by the FAA will evaluate the introduction of laser illumination marking systems on airport surfaces. The technology review will include the collection of a market survey from operators on the field that will encounter the system, and those that would maintain it. It will provide a current collection of the technology status as it influences pilots and airfield drivers in visually acquiring holding positions. The published review will include a synopsis of prior research in laser illumination, a listing and description of the currently available commercial laser illumination systems and their manufacturers, notes from the Society of Automotive Engineers SAE G-10 Committee on laser technology, and notes on past demonstrations of related technologies.

The Technology review specifically for the Airport Laser Holding Position Enhancement Project Program, is being developed by Greatland Laser LLC. The point of contact is Jim O'Meara and questions regarding the technology review in terms of patented systems may be directed to Jim O'Meara at (laser@alaska.net) or (907)245-4475.

3.3 User Survey

User survey will be conducted by FAA in cooperation with Greatland Laser LLC. and Galaxy Scientific Corporation. The user survey will be distributed to pilots and drivers that will encounter the laser marking enhancement, and airfield lighting maintenance technicians who would ultimately be responsible for the continued maintenance of equipment of this type. The data will be then be correlated and condensed into a report that will reflect the findings of the demonstration. The goal of the surveys and condensing report is to provide a validation tool into the value of the laser marking enhancement in reducing runway incursions and surface deviations. Since the human factor interface of operators making decisions based upon visual clues on airport surfaces is a subjective determination, the user surveys will provide analysts with a volume of data through which conclusions as to the effectiveness of the system can be judged.

The user survey forms will be distributed by the FAA Runway Safety Office and the Contractor with the assistance of Ted Stevens Anchorage International Airport Operations Staff, air carriers that operate at the

Ted Stevens Anchorage International Airport and the local regional representative of the Airline Pilots Association. All parties are active members of the Ted Stevens Anchorage International Airport Users Group and meet quarterly.

Instructions for completing the survey will emphasize that the survey is not to be completed in the cockpit or cab, but rather when the crew or driver have completed their on-airport activities. The survey is not intended to be an additional distraction, it is meant to be a feedback form that will standardize some of the responses in order to validate whether the laser illumination of the holding position marking is useful in further delineating the holding position.

3.4 Future Procurement Strategy and Options

Should this technology advance, it would fall into the realm of "Airfield Lighting", which would require certification. Pending certification as an approved lighting system, the Laser Enhanced Holding Position Marking would be a system normally procured by the airport owner-operator-authority, and would need to undergo review for Airport Improvement Program eligibility for Federal Assistance through the granting process. It is not anticipated that the FAA would own or operate a laser holding position enhancement system.

4.0 Contract Deliverables

- Program Plan and Presentation (August 2002)
- Detailed LIU Design Plan (September 2002)
- Delivery of LIU System (November 2002)
- Completion of Setup, Testing and Demonstration (November 2002)
- Delivery of Final Program Report (December 2002)

References

- National Blueprint for Runway Safety, Runway Safety Program Office, Federal Aviation Administration, October 2000.

- Federal Aviation Administration AC 150/5340-1H
- Federal Aviation Administration AC 150/5340-24
- Federal Aviation Administration AC 150/5340-28
- Federal Aviation Administration AC 150/5345-26
- Federal Aviation Administration AC 150/5345-42C
- Federal Aviation Administration AC 150/5345-46B
- Federal Aviation Administration AC 150/5345-47A
- Federal Aviation Administration AC 150/5345-50

Appendix 1

Functional and Operational Specifications of
Laser Illuminator Units for Airport Demarcation Markings
(Procurement Specifications)

1. Scope

This document describes a laser line generator and housing unit to be used to provide enhance visual guidance for pilots and ground personnel operating in the airport environment.

2. Reference Documents

- *AC 150/5340-1H*
- *AC 150/5345-26*
- *AC 150/5345-42C*
- *AC 150/5345-47A*
- *AC 150/5340-24*
- *AC 150/5340-28*
- *AC 150/5345-46B*
- *AC 150/5345-50*

3. Design Requirements

The Laser Illuminator Unit (LIU) shall be constructed for continuous or intermittent use at locations that are in close proximity to runways and taxiways, as shown in FAA AC 150/5340-1H and 18C.

4. Temperature

The LIU shall be designed and constructed to operate in temperature range from -40°C to +65°C, with an Extreme Cold Weather Climate Housing Package that will operate from –58°F to 120°F. The LIU head assembly shall contain all necessary temperature controls, heating and cooling circuits, and/or systems to allow the laser to turn on within 15 seconds of the time external circuit power is applied.

5. Duty Cycle

The LIU shall be designed to operate for 12 hours a day, 365 days per year. The life (average rated) of LIU shall be 4,380 hours at the above defined duty cycle.

6. Sun, Wind, and Rain

The LIU head assembly shall be constructed for continuous exposure to tropical sun, extreme cold, wind blown rain and snow, jet blasts up to 250 mph, 100% humidity, and frost. The LIU head assembly shall be a sealed unit using silicone rubber gasket with a hood and shield to prevent frost or snow from blocking the laser output, as well as to restrict direct laser source viewing at adjacent angles. A

temperature sensor with appropriate control circuits shall be incorporated to prevent the laser optics from becoming "Foggy."

7. Size and Shape

The LIU head assembly shall be designed and constructed to fit into a housing unit, as follows:

- The housing will be approximately a 6.5-inch diameter pressurized environment offering protection from destructive environmental forces. Construction will be of aluminum for protection from radio frequency interference. The housing will be a seamless cylinder with the following exterior dimensions: height, 7 inches; width, 8.6 inches; length, 18.7 inches. The total housing assembly with adjustable mounting will be about 14 inches from installation ground.
- The LIU head assembly's maximum length with a fixed-focal-length lens will be roughly 16 inches.
- The LIU mounting platform shall be attached to the rear end cap. Withdrawal of the rear end cap shall provide full access to the LIU head assembly and any other control and/or housing accessories.
- Fill and pressure-relief valves shall be easily accessible and the relief valve shall open when internal housing pressure reaches 10 psi.
- All electrical connection and/or control devices to the unit shall be made through a suitable rear-mounted connector.
- The housing shall be equipped with a thermostatically controlled heater that shall turn on the heater when the internal housing temperature falls below 68°F.

Table 1 provides a list of detailed measurements.

The LIU unit for this demonstration will be mounted on a metal base and secured with sandbags.

Table 1. Measurements

Dimensions (see Figure 1) Diameter of Cylinder: 6.5in (16.5 cm) Overall Height: 7.0 in. (17.8 cm) Overall Width: 8.63 in. (21.9 cm) Length (Including Connectors): 18.7 in (47.5 cm)	Maximum Optical Aperture/Lens Dimensions: See Figures 1 and 3 for height, width, and length
Weight: 15.8 lb (7.2Kg) Volume: 1.4 ft^3 (0.04m^3)	Construction: Housing: Seamless aluminum Window: Tempered glass
Mounting Provision: Eleven 0.281-inch (0.713cm) holes on housing mounting plate in patterns to match various Vicon pan-and-tilts, scanners, and wall mounts (see Figure 2)	NEMA Standard: Complies with NEMA 6 standard

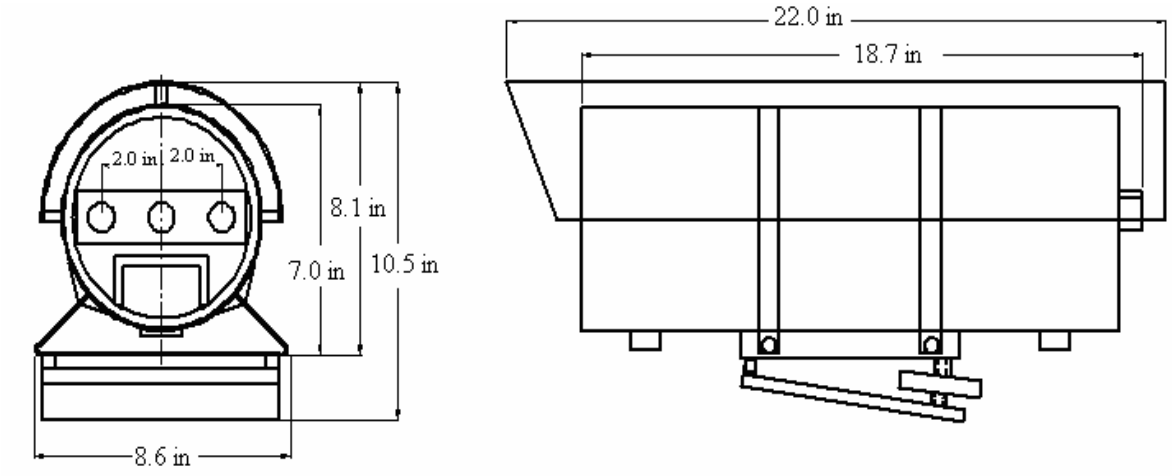


Figure 1. Housing Unit

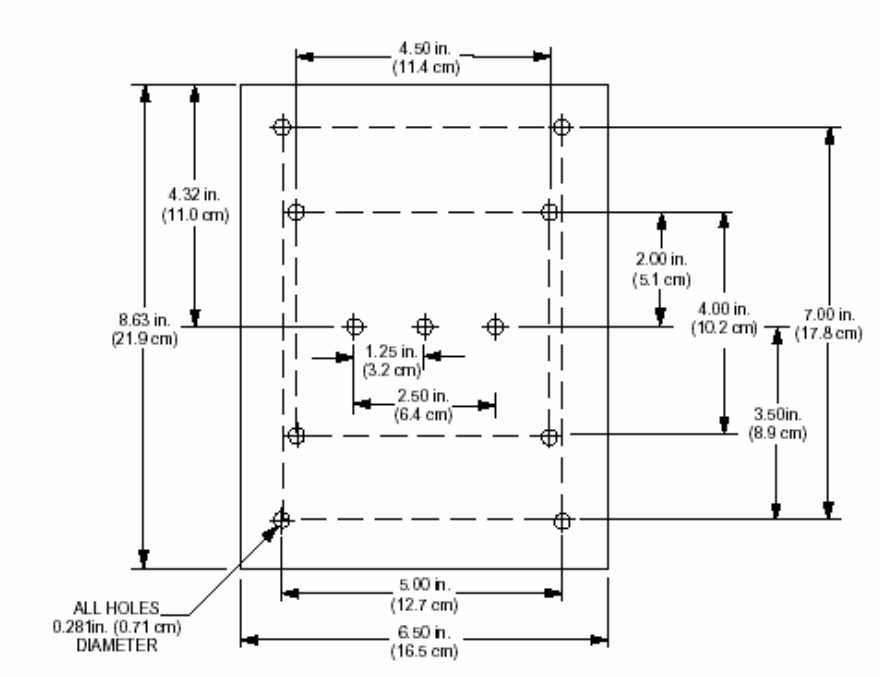


Figure 2. Mounting Hole Dimensions

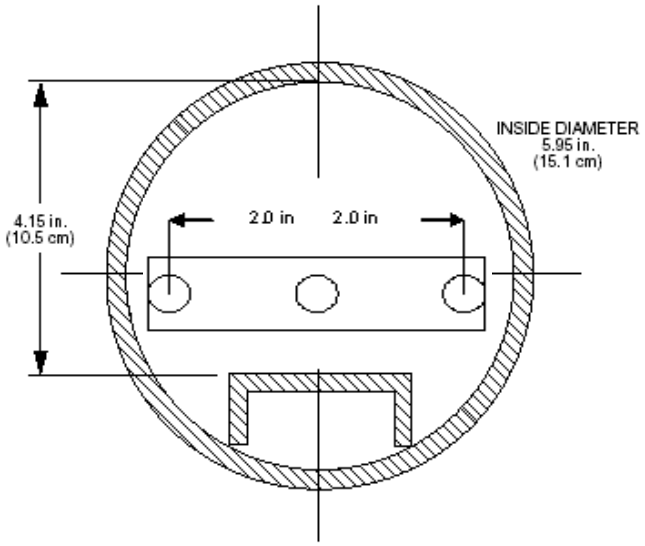


Figure 3. Maximum Optical Aperture /Lens Dimensions

8. Mechanical Housing and Mounting

The LIU for this demonstration is made of a pressurized housing suitable for outdoor installations. It is constructed of seamless aluminum tubing and the front window is made of tempered glass. This pressurized housing is designed to meet military specifications for resistance to destructive environmental forces. It meets the following standards and conditions:

- Ambient Temperature Limits: -40º to 140º F (-40º to 60º C)
- Altitude: Sea level to 10,000 ft (3,000m). MIL-SLD-810D, Method 500.2 procedure I

- Pressurization: Purge valve (for dry nitrogen) and pressure relief valve, pressurized to 10psi (70kg/sq cm), on housing
- Humidity: 100%. MIL-STD-810D, Method 507.2, Procedure I
- Salt Atmosphere: MIL-STD-810D, Method 509.2, Procedure I
- Shock: MIL-STD-810D, Method 516.3 Procedures I, II, V.
- Acoustic Noise: 150dB. MIL-STD-810D, Method 515.3
- Sand and Dust: MIL-STD-5400T Para 3.2.24.7 or MIL-STD-810D equivalent.
- Fungus: MIL-STD-5400T Para 3.2.24.8 or MIL-STD-810D equivalent.

9. Electrical

The LIU head assembly shall be designed and constructed to operate from a direct current source (in the mounting column), which will provide a voltage of 6 VDC to 12 VDC. The LIU head assembly shall contain transient protection circuitry so that the LIU will operate reliably during various weather extremes, such as thunderstorms normally encountered in the Southeast areas of the United States. Table 2 provides a detailed list of electrical specifications.

Table 2. Electrical Specifications

Total Power (Watt)	Approximately 180
Input Voltage (VDC)	12
Input Current (Amp)	15 Maximum
Laser/Driver Power (Watt)	<100
Heater Power	80
Heater Equivalent	4.6 btu/min (1.1 cal/min)
Connectors	All electrical connections are made through a 21-pin Bendix connector PT07C22-21P. Mating Cannon connector KPT06F22-21S or Bendix PT06E22-21S is supplied.

10. Optical Specifications

There will be one system consisting of two housing mechanisms located at each side of the taxiway. Each will be angled negative to the horizontal and will generate three parallel red or yellow lines (depending on a hold line or stop bar setup) of ½ inch diameter over the pavement at a length of 80 feet. The single system will be capable of generating both red and yellow lasers and will be demonstrated for both.

Locations of the LUIs (in reference to pavement edges) will coincide with position markings depicted in FAA AC 150/5340-1H and 18c. The LIU beam power shall be 50 milliwatts in red at 650 nm and 50 milliwatts in yellow roughly at 580 nm.

Table 3 gives a detailed list of all related optical specifications.

Table 3. Optical Specifications

Optical Specification (Out of Each Housing Mechanism)	Units	Min	Typical	Max
Number of Laser Beams			3	
Output Power Per Channel	mW	50	100	250
Wavelength #1 (Red)	nm	650	655	660
Wavelength #2 (Yellow)	nm		Composite Color, approx. 580nm	
Individual Beam Width (@ Exit)	mm		25	
Individual Beam Width (@ 80 Feet)	mm		75	
Beam Divergence (Vertical)	degree		5-30	
Beam Divergence (Horizontal)	mrad		2	
Beam Separation of Adjacent Channel (@ Exit)	mm		50	
Beam Separation (@ 80 Feet)	mm		Overlap	
Total Beam Width (@ Exit)	mm		100	
Total Beam Width (@ 40 Feet)	mm		132	
Total Beam Width (@ 80 Feet)	mm		163	

11. Safety Requirements

The LIU assembly shall be clearly marked with a Laser warning label, Warning Logo, Aperture Logo, and Identification Logo. The LIU head assembly will have a mechanical beam shutter, key-lock on/off switch, ready/emission indicator, power indicator, and a temperature sensor and indicator.

The laser system and its components will be designed and manufactured to the standards and requirements of ANSI Z136.1 and the Federal Laser Products Performance Standards, 21 CFR 1040.10 and 1040.11, and are subject to CDRH standards.

The beams shall always be pointed downward at a negative (below horizontal) angle to prevent direct eye contact.

Table 5 gives a detailed list of all control and safety parameters.

Table 5. Control and Safety Parameters

Control and Safety Features	
Laser Class	IIB
Mechanical Beam Shutter	yes
Warning Logo/Aperture Logo/Identification Logo	yes
Key-Lock	yes
Ready/Emission Indicators	yes
Power Indicators	yes
Temperature Sensors	yes

12. Access

The LIU head assembly will be capable of being repaired by a competent electronic repair person using plug-in modules. The LIU shall be designed and developed using a modular plug-in concept.

Laser Enhanced Holding Position Marking Demonstration Project
Ted Stevens Anchorage International Airport
Federal Aviation Administration Broad Agency Announcement
Contract: DTFA01-02-C-00090

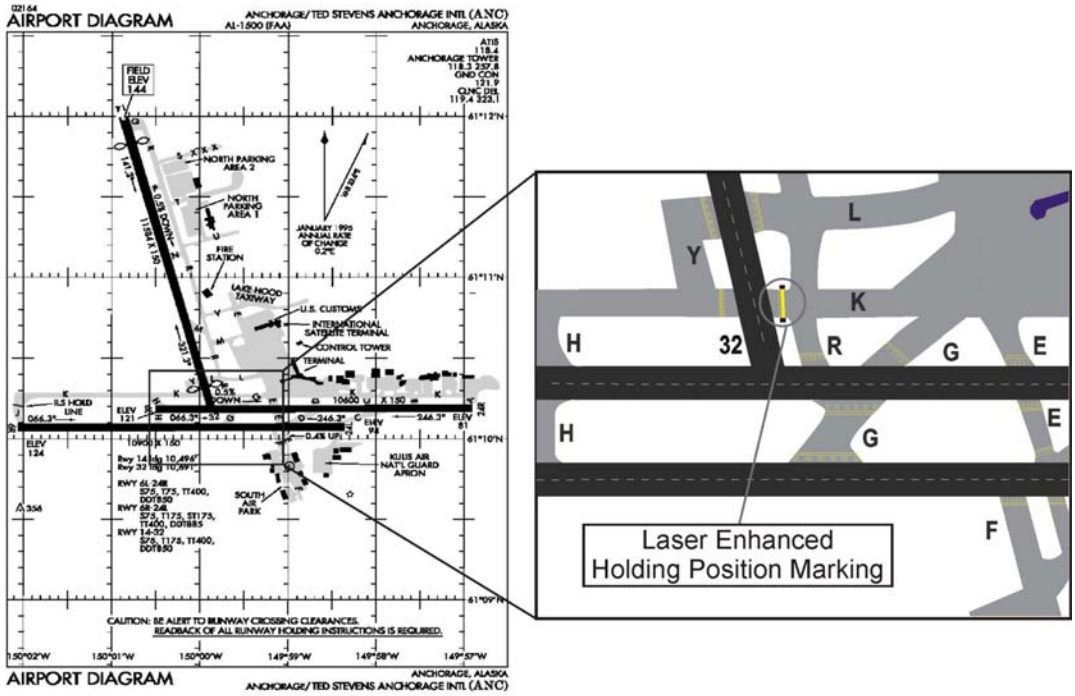
A large number of runway incursion events occur at holding positions as aircraft or vehicle operators cross holding positions and deviate onto operational runways. Principal reasons for the deviations are the operator misunderstood the Air Traffic Control instruction for routing, or the operator missed the visual cues at the holding position and crossed the holding point as the result of a situational awareness or positional error. The laser enhancement of holding positions is directed at improving performance in the later category of error where a surface operator unknowingly crosses the holding position and enters an active runway. However, the laser enhancement project could also deliver benefits in the first case through better visual cues that may cause an operator to question themselves as to their location and whether they had received a clearance to cross a holding position onto a runway.

The Laser Enhancement Program is designed to emphasize the holding position markings through the use of projected bright light across the first solid line of the holding position marking. The projected line will be drawn through the use of two Class IIIB, 50 milliwatt, pump diode laser projectors mounted facing each other on either side of the taxiway and perpendicular to the painted holding position marking. This project is not a replacement for the internationally recognized painted holding position marking; the projected laser line is only meant as an enhancement to existing marking, capitalizing on the advantages found in projected light as a supplementary surface marking. One of the objectives of this project is to test aircraft and vehicle operator visual acquisition of the holding position during periods of poor visibility and during weather that might occlude typical surface markings such as wet pavement conditions or blowing snow.

The Laser Enhanced Holding Position Marking will be tested at a single holding position at the intersection of Taxiway Kilo at Runway 32, on Ted Stevens Anchorage International Airport, from 4 November to 14 November between the hours of 1400 and 2200 local Alaska Standard Time. Operators transiting the laser enhanced holding position are asked to fill out a user response sheet that will assist the FAA in determining the usefulness and effect of the enhancement for future development.

Location of the Demonstration
4 November -14 November
Monday through Friday 1400-2200

For additional information contact the Contracting Officer's Technical Representative: Roger Motzko, Manager, FAA Alaskan Region Runway Safety Office, 907-271-5293



Laser Enhanced Holding Position Marking Evaluation

Ted Stevens Anchorage International Airport - November 4 -15 2002

FAA BAA Contract: DTFA01-00-R-01BAA For additional information contact:
Roger Motzko AAL1R, Federal Aviation Administration, 222 W 7th Ave #14, Anchorage AK 99513, Tel: 907-271-5293

While your opinion on this new lighting system is very important to us, we would ask that crew **not** fill out this form while taxiing the aircraft. Most runway incursions occur as a result of loss of situational awareness in the cockpit due to a distraction or flight deck workload. Thank you in advance for your participation.
Please evaluate the laser enchanced holding position marking system with the following rating system:

- 1 for poor or bad and 7 for improved or good
- For items that are not applicable use: **NA**
- Make sure the aircraft type field is filled in
- Fill in the **Email to** if you would like a copy of the final report sent at the end of the study in December
- Please leave the form with the dispatch office or gate agent, after the flight, with instructions to **fax to: 907-271-6211**

Aircraft Type: **Date**: **Time of Day**: **Email to:**

			1	2	3	4	5	6	7		NA
1.	While taxiing into position, how would you rate the effect of this device as a trigger to positional awareness in relation to the holdline (holding position)?	bad	☐	☐	☐	☐	☐	☐	☐	good	☐
2.	How would you rate the intensity of the Light?	bad	☐	☐	☐	☐	☐	☐	☐	good	☐
3.	How would you rate the overall appearance of the laser line?	bad	☐	☐	☐	☐	☐	☐	☐	good	☐
4.	How would you rate the consistency of color across the taxiway?	bad	☐	☐	☐	☐	☐	☐	☐	good	☐
5.	Rate the use of the laser enhancement in assisting you in determining your location on the taxiway in reference to the holding position.	bad	☐	☐	☐	☐	☐	☐	☐	good	☐
6.	Did the laser enhancement clearly mark the entrance/exit?	bad	☐	☐	☐	☐	☐	☐	☐	good	☐
7.	While taxiing through the intersection was the light beam distracting?	bad	☐	☐	☐	☐	☐	☐	☐	good	☐
8.	Did the light line serve as a holding position memory aid?	bad	☐	☐	☐	☐	☐	☐	☐	good	☐
9.	What was the general airport visibility along your taxi route (i.e. fog, wet pavement).	bad	☐	☐	☐	☐	☐	☐	☐	good	☐
10.	In your opinion, is the holding position improved or worsened with the laser enhancement?	worse	☐	☐	☐	☐	☐	☐	☐	better	☐
			1	2	3	4	5	6	7		NA

Additional Comments

Study results can also be found on: http://www.alaska.faa.gov/runwaysafety/

FAX completed copy to 907-271-6211, cover sheet not necessary