PAYLOAD HAZARD REPORT		a. NO: GHR-AMS02-016
b. Alphamagnetic Spectrometer-02 (AMS-02) GSE		c. II
d. SUBSYSTEM: Tracker Alignment System (TAS)	e. HAZARD GROUP: Lasers	f. DATE: May 2008
g. HAZARD TITLE: Exposure to Lasers		i. HAZARD CATEGORY ☒ CATASTROPHIC ☐ CRITICAL

h. APPLICABLE SAFETY REQUIREMENTS:
KHB 1700.7C, Section: 4.3.4.3.2 and 4.3.4.3.3.

j. DESCRIPTION OF HAZARD:

Personnel injury due to exposure to lasers.

Lasers are generated by Eagleyard EYP-RWL-1083 infrared (1083 nm) laser diodes with a maximum power output of 80 mW. Each laser will emit at a 100 Hz interval with 0.5 μs to 4 μs pulse duration when operating.

k. HAZARD CAUSES:

1. Laser is inadequately contained.

l. HAZARD CONTROLS:

(See continuation sheet)

m. SAFETY VERIFICATION METHODS:

(See continuation sheet)

n. STATUS OF VERIFICATION:

(See continuation sheet)

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II	TRENTMANN 10/3/08	10/3/08
PHASE III		

JSC Form 542B (Rev November 22, 1999) (MS Word September 1997)

PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO:	GHR AMS02-016
b. Alphamagnetic Spectrometer-02 (AMS-02) GSE	c. Phase	II

k. HAZARD CAUSES:
1. Laser is inadequately contained.

l. HAZARD CONTROLS:
1.1 Laser emissions occur inside sealed boxes and are conducted to the interior of the tracker via shielded fiber optic cables.

1.2 All connections and fiber optics cables are under thermal blankets.

1.3 There is no planned (nominal, contingency) access to the laser system.

m. SAFETY VERIFICATION METHODS:
1.1.1 Design review.

1.1.2 KSC "Use Authorization Approval".

1.2.1 Design review.

1.3.1 Design review.

n. STATUS OF VERIFICATION:
1.1.1 Open
1.1.2. Closed. Class 1 operational configuration approved by KSC per KU-G-50101 dated 03/05/2008
1.2.1. Open
1.3.1. Open

CHS

Comprehensive
Health Services
INCORPORATED

May 8, 2008 HP08-242

Mr. Leland Hill
ESCG GROUP/Jacobs Engineering
224 Bay Area Blvd. Box 7
Houston, TX 77058

RADIATION PROTECTION PROGRAM APPROVAL OF RADIATION USE AUTHORIZATION NO. K-GU-50101, MODIFICATION 000

The subject Radiation Use Request/Authorization has been evaluated in accordance with KSC Radiation Protection Program requirements.

This Radiation Use Authorization (RUA) has been reviewed and approved by the KSC Radiation Protection Officer. Attached is the RUA outlining use requirements.

If you have any questions regarding this Radiation Use Authorization, please contact the undersigned at 853-5688.

Rod E. Nickell
Health Physics Manager

REN:msj

Attachment as stated

cc: Randy Scott, TA-C2

LASER DEVICE USE REQUEST / AUTHORIZATION

(Please Type / Print Legibly)
(Note - Complete Unshaded Sections of Form Only) (Instructions for completion in Field Help)

Originator Name/Telephone	Organization Mail Code / Address	Date	Authorization Number
Leland D. Hill / 281 461 5701	JE-46B / JSC / HOUSTON	3/19/2008	K-GU-50101

I. LASER DESCRIPTION

A.

1. Type of Laser	2. Manufacturer	3. Model Number	4. Serial Number	5. ANSI Class	6. Registration Number (if applicable)
Laser diode	Eagleyard	EYP-RWL-1083		3A(pulse) 3B(cont)	

7. Operating Mode	8. Peak Power	9. Pulse Length	10. Pulse Frequency	11. Wavelength	12. TEM	13. Beam Diameter	14. Aperture	15. Divergence	16. Scanning (if applicable) a. Rate	b. Angle
Pulse	80mW	8μS	1kHz	1083nm	00	0.02mm at source		0.5 rad	—	—

*

1. Type of Laser	2. Manufacturer	3. Model Number	4. Serial Number	5. ANSI Class	6. Registration Number (if applicable)
diode-fiber internal emmission	Output from LBBX	—	—	—	

7. Operating Mode	8. Peak Power	9. Pulse Length	10. Pulse Frequency	11. Wavelength	12. TEM	13. Beam Diameter	14. Aperture	15. Divergence	16. Scanning (if applicable) a. Rate	b. Angle
Pulse	160nJ assume no loss	8μS	1kHz	1083	00	1.4mm	—	1m rad [redacted]		

C.

1. Type of Laser	2. Manufacturer	3. Model Number	4. Serial Number	5. ANSI Class	6. Registration Number (if applicable)

7. Operating Mode	8. Peak Power	9. Pulse Length	10. Pulse Frequency	11. Wavelength	12. TEM	13. Beam Diameter	14. Aperture	15. Divergence	16. Scanning (if applicable) a. Rate	b. Angle

II. AREA DESCRIPTION

A. Use Location
Area SSPF - PAD
Building No. _____
Room Number _____

B. Storage Location
Area SAME
Building No. _____
Room Number _____

C. Attach sketch of system use area including locations of devices, beam paths, warning lights, interlocks, etc.
INTERNAL TO FLIGHT HARDWARE

D. Provide optical path sketch (if applicable)

III. USE DESCRIPTION

A. Mission/Payload Designation AMS-02

B. Brief description of use INTERNAL TO FLIGHT HARDWARE SYSTEM DETECTS RELATIVE DISPLACEMENT OF THE TRACKER PLANES

IV. PROCEDURES

A. Operating Procedures: TBD

B. Accident/Emergency Procedure: _____

C. Maintenance Procedure: _____

D. Attach copies of procedures.

V. SYSTEM USERS

A. Area Radiation Officer Leland Hill

B. Use Supervisor/Custodian Leland Hill

C. Attach list of user/operators ☐ Yes ☐ No ☑ N/A

D. Submit Completed KSC Form 16-450 for each of the above named individuals ☐ Yes ☐ No ☑ N/A

E. Maintenance/Calibration Organization _____

VI. PROPOSED PERIOD OF USE

From: _____ To: _____

VII. SIGNATURES

A. Originator _____ Date _____

B. Area Radiation Officer _____ Date _____

VIII. AUTHORIZING SIGNATURES

Health Physics R. L. Bullock	Date 4/21/08
KSC Radiation Protection Officer [signature]	Date 5/2/08
ESMC Radiation Protection Officer (if applicable)	Date
Chmn. KSC Radiation Protection Committee [signature]	Date 5/2/08

KSC FORM 16-447 (REV. 8/91) PREVIOUS EDITIONS ARE OBSOLETE

RADIATION TRAINING & EXPERIENCE SUMMARY
(NONIONIZING RADIATION)

Please Type /Print Legibly
Instructions for completion on next page

I. GENERAL INFORMATION

A. Applicant Name/Telephone	B. Date of Birth	C. Organization Mail Code	D. Reference Number
Leland D. Hill - 281 4615701	02-29-1964	JSC/ESG/JE4EB	K.GU.50101

E. Badge Number	F. System/Device to be Used
	Alpha Magnetic Spectrometer -02 TRACKER ALIGNMENT SYSTEM

G. Type of User

- [x] Area Radiation Officer
- [ ] Operator
- [ ] Use Supervisor/Custodian
- [ ] Maintenance
- [ ] Other (describe) _____

II. TRAINING *(Use Supplemental Sheets as Needed)*

TYPE OF TRAINING	YES	NO	WHERE TRAINED	DURATION
A. Biological Effects	X		JSC - Flight Safety Aspects	1 day
B. Radiation Protection				
C. Other				

III. EXPERIENCE *(Use Supplemental Sheets as Needed)*

TYPE OF EXPERIENCE	LOCATION	DURATION
A. Payload Flight Safety Engineer	Johnson Space Center	20 yrs.
B. *design Analysis & compliance		
C. AMES RESEARCH CENTER INDEPENDENT INVESTIGATION OF WIND TUNNEL LASER INCIDENT	Ames Research Center	5 days
D.		

IV. REFERENCE DOCUMENTS

I have read and understand the following:

A. KMI 1860.1	[x] Yes	[ ] No	[ ] N/A	E. 45th SWI 40-201	[ ] Yes	[ ] No	[x] N/A
B. KHB 1860.2	[x] Yes	[ ] No	[ ] N/A	F. Fla. Administrative Code Chapter 64E-5	[ ] Yes	[ ] No	[x] N/A
C. 29 CFR 1910.97	[x] Yes	[ ] No	[ ] N/A				

Signature of Applicant _____ Date _____

Signature of ARO [signature] Date 3/26/2008

V. AUTHORIZING SIGNATURES

Health Physics [signature]	Date 4/21/08
KSC Radiation Protection Officer [signature]	Date 5/2/08
45th SW Radiation Protection Officer (if applicable)	Date
Chmn. KSC Radiation Protection Committee [signature]	Date 5/2/08

KSC FORM 16-450 RS (REV. 4/97) PREVIOUS EDITIONS ARE OBSOLETE

RADIATION PROTECTION PROGRAM USE AUTHORIZATION

Use Authorization: **K-GU-50101** **Modification:** **000** **Date:** **04/14/2008**

User Organization: **Johnson Space Center**
JE-4EB
Houston, TX

Area Radiation Officer: **Leland Hill** Phone: **(281) 461-5701** Fax:

Use Authorization (UA) K-GU-50101 is issued subject to the controls and provisions specified herein.

I. PROTECTION GUIDES:

The Protection Guides (PGs) applicable to the evaluation of this UA is as determined in accordance with ANSI Z136.1and specified for each authorized source in Section VI.A. of this UA.

II. USE DESCRIPTION: Class 3R laser / Tracker Alignment System -Alpha Magnetic Spectrometer 02, internal to flight hardware, operated in a Class 1 configuration.

III. AUTHORIZED SOURCES AND APPROVED USE / STORAGE LOCATIONS:

Use Authorization K-GU-50101 provides for the radiation sources and locations described below:

A. Authorized Sources:

Manufacturer	No of Sources	Model Number	Serial Number	Wavelength (nanometers)	Class	Use Description
Eagleyard	1	EYP-RWL 1083	N/A	1083 nm	IIIR	Tracker Alignment

B. Authorized Locations:

Building/Area I.D	Location Type	Source Authorization
SSPF/PAD 39	Testing/USE	Alpha Magnetic Spectrometer (AMS – 02)

IV. AUTHORIZED PERSONNEL:

The following named personnel are approved for activities under Use Authorization K-GU-50101.

Name	Function / Duties
* Leland Hill	Area Radiation Officer (ARO)

* Training & Experience Summary Form attached. All users will be under the supervision of the ARO / US/C and be familiar with the control provision outlined below.

V. PROCEDURES:

Use of the laser identified by the provisions of this UA will be in accordance with user-submitted procedures identified below and the radiation protection controls and provisions identified in Section VII of this UA.

1) Manufacturer's recommended precautions and operating procedures.

VI. HAZARD EVALUATION:

Hazard evaluations have been made based on the Protection Guide (PG) and operating parameters identified for the authorized source specified in Section A. below:

A. Evaluation Parameters:

1. AMS-02 Lasers

Manufacture	:	Eagleyard
Laser Type	:	Diode
Wavelength	:	1083 nm
Peak Power	:	160 nJ (peak)
Pulse Length	:	8usec
Operating Mode	:	Pulsed
Beam Divergence	:	1.0 mrad
Beam Diameter	:	1.14 mm
MPE (Ocular)	:	420 nJ/cm^2

B. Worst-Case Hazard Assessment:

Worst-case hazard assessment defines the controlled area and any personal protective equipment requirements for operation of the authorized lasers under 'uncontrolled' conditions.

Nominal Ocular Hazard Distance (NOHD)

The NOHD is defined for unprotected intrabeam viewing (IBV) conditions.

Optical Density (OD) Requirements

The OD is defined at specific wavelengths for unprotected IBV exposure conditions within the NOHD.

Source Description	NOHD	OD
Alpha Magnetic Spectrometer (AMS – 02)	6.809 m	1

- Normal operating configuration does not require an NOHD or an OD unless maintenance is being performed on the AMS-02 laser.

VII. CONTROL PROVISIONS:

Continued authorized use of the source identified by this UA is contingent upon operations in accordance with the representation of the LDURA submitted and the controls and provision described herein.

A. Operational Controls:

1. Laser Radiation Controlled Areas (LRCA)

The AMS-02 is a Class 3R operated in a Class 1 configuration. No laser controlled area is required as long as the AMS-02 is operated in a Class 1 configuration. Maintenance on the AMS-02 will require a Laser Radiation Controlled Area (LRCA). The (LRCA) as required and defined by this document will be posted in accordance with the provisions of this UA and access limited to approved user/operator personnel.

2. Notification Requirements

a. Telephone numbers for the Health Physics Office (HPO) notifications are:

During Normal Working Hours: (Mon-Fri 0700-1700)	HPO	:	853-5688
Kennedy Space Center	RPO	:	867-6958
After Normal Working Hours:	KSC/CCAFS	:	853-5211

b. ARO must notify the HPO upon transfer of the laser sources to other use/storage locations at KSC/CCAFS.

c. ARO must notify the HPO upon transfer of the laser sources on or off of KSC/CCAFS areas.

d. All real or suspected exposures to laser radiation must be immediately reported to the HPO.

e. Operators are not required to notify the HPO prior to operations of laser sources.

f. Operators are required to wear eye protection within the NOHD per section VI. B during operations/maintenance other then the Class 1 configuration.

3. Medical Surveillance Requirements

Medical certification of eye examinations is not required.

A. Operational Controls: (cont.)

4. Postings and Labeling Requirements

   a. The LRCA as defined in Section VII.A.1 of this UA will be posted with approved "Laser Warning Signs" and will be as defined by ANSI Z136.1. (2007), whenever the lasers are having maintenance performed on them or being operated in other than a Class 1 configuration. (Prior approval from the HPO will be required for any operations of the lasers in other then a Class 1 configuration while at KSC).

   b. Where posting of the LRCA is not feasible; surveillance of the area will be maintained by the system operators to verify a clear in the immediate work area prior to and during operations. (prior approval from the Health Physics Office at KSC will be required).

   c. All lasers will be appropriately labeled in accordance with their ANSI classification. Labels shall be affixed to a conspicuous location on the laser housing.

5. Inventory/Accountability Requirements

   a. Inventory and accountability control of all lasers shall be maintained by the ARO.

   b. The ARO will functions as the point of contact for scheduling of periodic survey/audits by the HPO.

6. General Operating Provision

   a. The laser system will be operated only by qualified and authorized personnel identified by Section IV of this UA.

   b. Personnel whose job duties require entry into LRCA's shall be adequately trained, provided with appropriate protective equipment where required, and be familiar with the administrative and procedural controls established by operating procedures and this UA.

   c. Maintenance of the lasers sources must be performed by qualified and approved personnel.

   d. It is the responsibility of the user organization ARO to supply the hazard evaluation information listed in Section VI.B. of this UA to the organization performing maintenance on the laser device(s).

   e. Use of a laser **"beam stop"** is required during maintenance laser operations. All personnel within the NOHD must wear approved laser eye protection.

B. Administrative Provisions

1. Authorized Use Period

   Radiation Use Authorization K-GU-50101 is a General Use Authorization and is valid for an indefinite period of time, for the sources, personnel, use/storage locations and the procedures identified in this document.

RADIATION PROTECTION PROGRAM USE AUTHORIZATION

Use Authorization: **K-GU-50101** **Modification:** **000** **Date:** **04/14/2008**

B. Administrative Provisions (cont.)

2. Changes to Authorized Use

   a. Changes in sources, procedures, personnel, or use/storage location as described by Use Authorization K-GU-50101 must be identified through submittal of KSC Form 16-353NS "Modification of Radiation Use Authorization" describing such changes to the KSC Radiation Protection Office (TA-C2).

   b. Request for changes in authorized use must be submitted not less than thirty (30) days prior to Implementation of intended change, as described by KNPR-1860.2 "KSC Nonionizing Radiation Protection Program".

3. Operations not in accordance with the conditions or this Use Authorization may result in revocation of Use Authorization and possible impoundment of radiation source.

4. Further correspondence regarding sources, personnel or procedures governed by this Use Authorization must reference Use Authorization Number K-GU-50101.

CHS/Health Physics Dept. Date: 4/21/08

NASA/KSC Radiation Protection Officer Date: 5/2/08