1.1 Night Readability Ground Evaluation – NVG AIDED

1.1.1 Objective of Test

The objective of this test is to evaluate the NVIS lighting and cockpit for NVG compatibility. This evaluation shows compliance with 14 CFR 27 or 29 sections 771, 773, 777, 1301, 1321(a), 1381(b) relative to a pilot wearing NVGs.

Pass/Fail Criteria:

The lighting system does not cause loss of visual acuity from the baseline visual acuity determined using the following procedures. Loss of visual acuity for the purposes of this evaluation is the inability to resolve the original baseline USAF Tri-Bar chart element. The Master Warning/Caution lights, Fire lights, and Caution Warning panel elements are allowed to cause loss of one element of the USAF Tri-Bar chart acuity.

The lighting system does not cause veiling glare or blooming of the NVG when looking cross-cockpit.

1.1.2 Test Set-Up (See "Ground-Evaluation Set Up" Checklist)

1.1.2.1 Required Items

1) A facility that can be sealed from all light sources. The facility must have a minimum of 25 feet of space in front and sufficient room to either side of the aircraft to accommodate test equipment setup. Note: If the Tri-bar chart is visible with unaided vision, the facility is not dark enough.
2) Visual Acuity Chart (a USAF 1951 Resolution Resolving Power Target Medium Contrast (Tri-Bar) Chart and USAF 1951 Resolution Resolving Power Target High Contrast (Tri-Bar) Chart, copies at end of checklist)
3) Visual acuity chart illuminator capable of illuminating acuity charts at levels found in Table 1 – Lux.
4) Light meter capable of measuring in hundredths of LUX at levels found in Table 1 – Lux.
5) At least two NVG helmets with mounts for front seat evaluators. NVG hand held mounts with power supply can be used for other observers if desired.
6) A minimum of one set of NVG for each front seat evaluator that meets TSO-C164 or RTCA/DO-275 specifications.
    a) Use the same type/model of NVG that operator will use in flight if possible.
7) Familiarize evaluator crew with A/C switch locations/positions so they can activate correct switches in a dark environment (BAT, NAV, COMM, Lights, operation equipment, etc.)

1.1.2.2 Equipment Set-Up

1) Position the aircraft in a facility that can be sealed from all light sources. The facility must have a minimum of 25 ft of space in front and sufficient room to either side of the aircraft to accommodate the test equipment setup.
2) Check and clean the windscreen/windows if necessary to remove any smudges and bugs. Ensure the windscreen is not excessively scratched.
3) Provide at least two each NVG helmets with mounts for front seat evaluators. NVG hand held mounts with power supply if desired for other observers.
4) Provide the same model and part number of the Night Vision Goggles used by the applicant for operations. Record the NVG information on the checklist. Use both Class A or Class B NVGs unless the lighting system STC is limited for use with Class B NVG only.
5) Connect appropriate ground power unit to facility power and to the aircraft GPU connector. Do not turn ground power on until instructed.
6) Evaluator must be familiar with A/C switch positions and be able to activate correct switches during a darkened condition (BAT, NAV, COMM, Lights, operating equipment, etc.).
7) Position a USAF 1951 Resolution Resolving Power Target Medium Contrast (Tri-Bar) Chart and USAF 1951 Resolution Resolving Power Target High Contrast (Tri-Bar) Chart 20 feet in front of and level with the pilot's eye position (see Figure 1).
8) Use a Visual Acuity Chart Illuminator to illuminate the resolution chart. Place the illuminator at the distance discussed in the chart from Table 1. Assess whether or not the light source illuminates or casts shadows into the cockpit. If it does, move the light source to eliminate any cockpit illumination or shadows.
9) Connect the illuminator to correct power supplied from the testing facility.
10) Position the light meter sensor 12.0 inches (30.5 cm) from the front of the light source baffle.
    a) Note: Distance is critical, be as accurate as possible.
11) Set the light meter switch to measure in LUX.
12) Turn on the Illuminator and turn off all hangar lights.
13) Record the reading for the light meter.
    a) **Light meter Lux Reading:** _____
14) Locate the Lux value in the first column of the Table 1 and record value
15) Set the distance from the Illuminator to the Target by moving the Illuminator to the distance recorded in Step 14 (See Figure 1).
16) Ensure the target is centered in the illuminated area and that the light does not enter the cockpit or reflect into the cockpit onto the instrument panel. This may be accomplished by observing the cockpit and instrument panel using NVGs.

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Table 1 – Lux

Distance					
Lux @ 12 inches (30.5 cm)	Decimal (ft)	Feet	Inches	M	cm
.08	14.48	14	5 ¾	4.41	441.35
.09	15.35	15	4 ¼	4.68	467.87
.10	16.18	16	2 ¼	4.93	493.17
.11	16.97	16	11 ¾	5.17	517.25
.12	17.73	17	8 ¾	5.40	540.41
.13	18.45	18	5 ½	5.62	562.36
.14	19.15	19	1 ¾	5.84	583.69
.15	19.82	19	9 ¾	6.04	604.11
.16	20.47	20	5 ¾	6.24	623.93
.17	21.10	21	1 ¼	6.43	643.13
.18	21.71	21	8 ½	6.62	661.72
.19	22.31	22	3 ¾	6.80	680.01
.20	22.89	22	10 ¾	6.98	697.69
.21	23.45	23	5 ½	7.15	714.76
.22	24.01	24	0	7.32	731.82
.23	24.55	24	6 ½	7.48	748.28
.24	25.07	25	¾	7.64	764.13
.25	25.59	25	7	7.80	779.98
.26	26.10	26	1 ¼	7.96	795.53

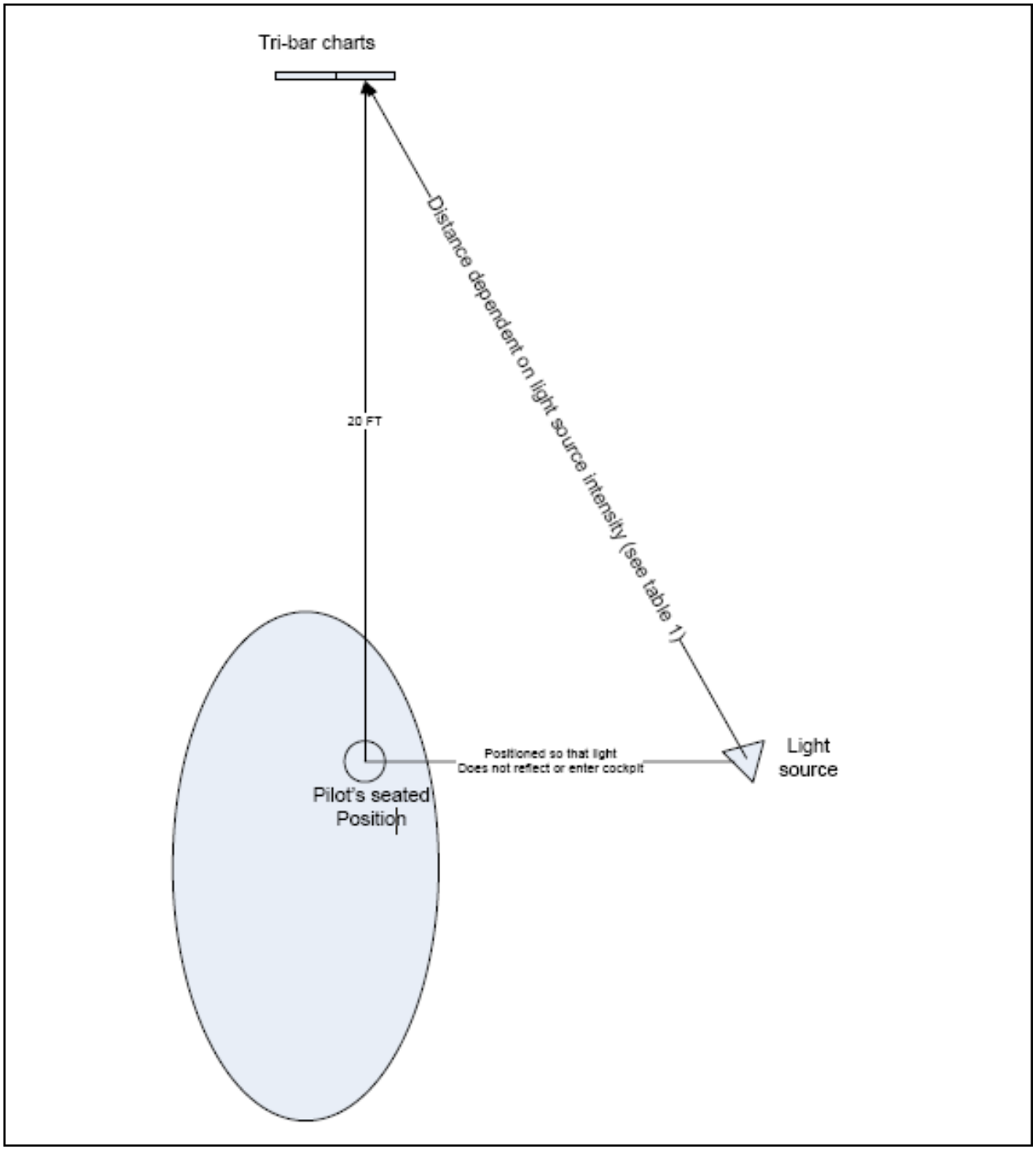

Figure 1 – Target & Illuminator Set-Up

Night NVG Aided Readability Ground Evaluation

Evaluator(s):		Date:	
Applicant/STC Holder:		Make/Model:	
Modification/Kit Installer:		Serial No.:	
Operator:		Registration No.:	

NVG Information

Crew	Manufacturer	Model/Class A - B	Part number/ Serial Number	Focused Acuity
Pilot				
Copilot				
Observer 1				
Observer 2				

Test Preparations

1) Verify NVGs are functioning properly and have no defects that would affect test results. ☐

2) Focus NVG goggles per manufacturer's instruction ☐
This is best accomplished using a slightly higher light condition than provided by the illuminator

3) Turn on the chart illuminator ☐

4) Stand outside the aircraft, abeam pilot position (20 ft from illuminated chart) and focus NVG to obtain maximum resolution of chart (smallest set of horizontal and vertical bars). ☐
   A. Record value in the NVG Information Table above

1) All Cockpit lights – OFF
View target through aircraft windscreen from each crew position. Record chart line visibility.

Remarks/ Comments

☐ SAT ☐ UNSAT	**Chart Line** _____

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2) NVIS Map/Emergency/Flood Lights – ON
NVIS Instrument Lights (including filtered instruments) – OFF
NVIS Filtered Equipment (i.e. radio stacks, GPS, clocks, etc) – OFF
Illumination Level – NVG OPERATIONAL LEVEL

A. View target through aircraft windscreen and record chart line visibility

Remarks/ Comments	
☐ SAT ☐ UNSAT	**SAT: No loss of chart resolution** **Chart Line** _____

B. Record and assess any reflections/glares created by the NVIS Map/Emergency/Flood Lights

Remarks/ Comments	
☐ SAT ☐ UNSAT	**SAT: No reflections in pilot forward visual field that cause a loss of chart resolution. Cross cockpit reflections of concern may require flight evaluation.**

C. Scan the instrument panel and consoles and record any light leaks, “hot spots” or glare in NVG and its effect on NVG performance

Remarks/ Comments	
☐ SAT ☐ UNSAT	

D. Record position, type, and effect of any instrument light reflections in windscreen or windows seen through the NVG and effect on NVG performance/outside visibility in both the forward and cross-cockpit views.

Remarks/ Comments	
☐ SAT ☐ UNSAT	**SAT: No reflections in pilot forward field of view that cause a loss of chart resolution. Forward field of view and cross-cockpit reflections of concern may require flight evaluation.**

Night NVG Aided Readability Ground Evaluation

3) NVIS Map/Emergency/Flood Lights – OFF
NVIS Instrument Lights (including filtered instruments) – ON
NVIS Filtered Equipment (i.e. radio stacks, GPS, clocks, etc) – OFF
Illumination Level – NVG OPERATIONAL LEVEL

A. View target through aircraft windscreen and record chart line visibility

Remarks/ Comments	
☐ SAT ☐ UNSAT	**SAT: No loss of chart resolution** **Chart Line** _____

B. Scan the instrument panel and consoles and record any light leaks, “hot spots” or glare in NVG and its effect on NVG performance

Remarks/ Comments	
☐ SAT ☐ UNSAT	

C. Record position, type, and effect of any instrument light reflections in windscreen or windows seen through the NVG and effect on NVG performance/outside visibility in both the forward and cross-cockpit views..

NOTE: Pay attention to warning/failed flags, marker lights, and other lights accompanying instrument lights that might illuminate and could cause degradation of NVG performance or could create unnecessary distraction to the pilot.

Remarks/ Comments	
☐ SAT ☐ UNSAT	**SAT: No reflections in pilot forward field of view that cause a loss of chart resolution. Forward field of view and cross-cockpit reflections of concern may require flight evaluation.**

Night NVG Aided Readability Ground Evaluation

4) NVIS Map/Emergency/Flood Lights – OFF
NVIS Instrument Lights (including filtered instruments) – ON
NVIS Filtered Equipment (i.e. radio stacks, GPS, clocks, etc) – ON
Illumination Level – NVG OPERATIONAL LEVEL
FLIR/Video/Low-Light Camera Systems/Auxiliary Displays (if installed) – ON

A. View target through aircraft windscreen and record chart line visibility

Remarks/ Comments	
☐ SAT ☐ UNSAT	**SAT: No loss of chart resolution** **Chart Line** _____

B. Scan the instrument panel and consoles and record any light leaks, “hot spots” or glare in NVG and its effect on NVG performance

Remarks/ Comments	
☐ SAT ☐ UNSAT	

C. Record position, type, and effect of any instrument light reflections in windscreen or windows seen through the NVG and effect on NVG performance/outside visibility in both the forward and cross-cockpit views.

Remarks/ Comments	
☐ SAT ☐ UNSAT	**SAT: No reflections in pilot forward field of view that cause a loss of chart resolution. Forward field of view and cross-cockpit reflections of concern may require flight evaluation.**

Night NVG Aided Readability Ground Evaluation

5) NVIS Map/Emergency/Flood Lights – OFF
NVIS Instrument Lights (including filtered instruments) – ON
NVIS Filtered Equipment (i.e. radio stacks, GPS, clocks, etc) – ON
Illumination Level – NVG OPERATIONAL LEVEL
FLIR/Video/Low-Light Camera Systems (if installed) – ON
Aft Compartment Lights – ON
Light Curtain (If Installed) – IN PLACE

A. View target through aircraft windscreen and record chart line visibility

Remarks/ Comments	
☐ SAT ☐ UNSAT	**SAT: No loss of chart resolution** **Chart Line** _____

B. Scan the instrument panel and consoles and record any light leaks, “hot spots” or glare in NVG and its effect on NVG performance

Remarks/ Comments	
☐ SAT ☐ UNSAT	

C. Record position, type, and effect of any instrument light reflections in windscreen or windows seen through the NVG and effect on NVG performance/outside visibility in both the forward and cross-cockpit views

Remarks/ Comments	
☐ SAT ☐ UNSAT	**SAT: No reflections in pilot forward field of view that cause a loss of chart resolution. Forward field of view and cross-cockpit reflections of concern may require flight evaluation.**

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6) All Cockpit lights – ON
Master Caution/Warning Lights – ON

View target through aircraft windscreen from each crew position. Record chart line visibility.

NOTE: Some glare/blooming/degradation in NVG performance may be acceptable since Master Caution/Warning lights are designed to attract pilot attention. Acceptability dependent on aircraft system, when the lights are programmed to illuminate, and the position within the pilot's NVG FOV. Evaluator Pilot Judgment. However, one element of NVG visual degradation as a result of CAWS panel lighting is permissible.

Remarks/ Comments

SAT: Loss of one element chart visual acuity

Chart Line _____

☐ SAT

☐ UNSAT

7) All Cockpit lights – ON
Caution Advisory Warning Panel Lights – ON

View target through aircraft windscreen from each crew position. Record chart line visibility.

NOTE: Some glare/blooming/degradation in NVG performance may be acceptable since Master Caution/Warning lights are designed to attract pilot attention. Acceptability dependent on aircraft system, when the lights are programmed to illuminate, and the position within the pilot's NVG FOV. Evaluator Pilot Judgment. However, one element of NVG visual degradation as a result of CAWS panel lighting is permissible.

Remarks/ Comments

SAT: Loss of one element chart visual acuity

Chart Line _____

☐ SAT

☐ UNSAT

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8) Check pilot's/observers ability to move in cockpit, view and operate switches/controls with NVGs in viewing and stowed positions.

A. Record Pilot/Observer ability to see/access overhead panel switches and controls

Remarks/ Comments	
☐ SAT ☐ UNSAT	

B. Record Pilot/Observer ability to see/access side/center panel(s) switches and controls.

Remarks/ Comments	
☐ SAT ☐ UNSAT	

C. Record and interference with aircraft ceiling, structures, controls

Remarks/ Comments	
☐ SAT ☐ UNSAT	