LEVEL 2 CERTIFICATION

STK Master

Ansys

Certification test instructions

Read these instructions before starting your test:

NOTE: Trainees must be Level 1 – STK Certified to enroll in the Level 2 – STK Master Certification.

1. **Install the most current version of the Ansys Systems Tool Kit (STK®) digital mission engineering software:** Download the STK software, then install and license it on your computer. We recommend using the latest version of the STK software.
2. You can also take this test using the Ansys Systems Tool Kit (STK®) Cloud™ web browser-based digital mission engineering software, which does not require a download or installation on your local machine.
    a. **NOTE**: If you want to use the STK Cloud software to take this Certification test and do not have access to a STK Cloud software trial, email certification@agi.com to help gain access.
3. **License the STK software:** Follow the license instructions in the registration email.
4. **Find the Level 2 - Advanced tutorials:** Select one of two methods (a or b) to access our catalogue of advanced tutorials:
    a. Level 2 – Advanced sections of training online at: help.agi.com/stk/#training/TutorialOverview.htm.
    b. Level 2 – Advanced sections of training locally in the STK application:
        i. Click Help
        ii. Select Training and Tutorials
        iii. Select View the Complete list of tutorials
        iv. Select Level 2 – Advanced
5. **Complete these prerequisite tutorials:** these tutorials from the Level 2 – Advanced section will help prepare you for this test. You should complete these tutorials first.
    a. Part 6: Introduction to the Pro Capabilities
    b. Part 7: Customize Analysis with Analysis Workbench
    c. Part 8: Compute Coverage Over Regions
    d. Part 11: Introduction to Communications
    e. Part 12: Introduction to Radar
    f. Part 14: Model Aircraft Missions with Aviator
    g. Part 16: Design Trajectories with Astrogator
6. **Complete the Scenario Development Exercises in this test:** This test has four Scenario Development Exercises, each with a number of tasks and questions.
    a. The test questions are in bold.
    b. Only change property settings stated in the steps. Otherwise, use the default property settings.
    c. Complete all steps for the four Scenario Development exercises contained in this document.
    d. There is a total of 40 multiple choice questions to answer after the development of the scenarios.

** This test must be completed independently and must be **your own work**.**

7. **Submit answers in ClassMarker:**
    a. Follow the instructions in the registration email to log in to ClassMarker.com.
    b. Submit your answers there.

Please Note: *Once you click "Finish Now" and submit your test online, it will be graded immediately. You will receive an email letting you know if you passed.*

- **NOTE**: How to save your STK scenarios:
    - If you are using STK Desktop, you can save the scenario to your computer file directory (e.g. Documents > STK 12).
    - If you are using STK Cloud, you can save the scenario to STK Cloud's File Directory (e.g. Documents > STK 12). When finished, you can zip and download the folder to your local machine. Please note, STK Cloud sessions are non-persistent, meaning that once your session has ended, your data will be gone when you start your next session. The following steps outline how to download your STK scenarios to your local machine. Please reference the STK Cloud Help for more information: https://help.agi.com/stkcloud/stkCloud.htm.
        - Save the scenario to the STK Cloud's File Directory.
            - Click Save () when the scenario loads.
            - Ensure File System is selected for the Location.
            - Navigate to Documents > STK 12.
            - Create a folder with the same name as your scenario.
            - Open the new folder.
            - Ensure Scenario files (*.sc) is selected as the Save as type.
            - Click Save.
        - Once you are ready to save your STK scenario to your local machine, zip up your scenario folder.
            - Save your scenario in the folder you created on STK Cloud.
            - Click on the Gear () icon in the bottom left of your STK Cloud browser window.
            - Select Frame Explorer.
            - Navigate to the scenario folder you want to copy to your local machine.
            - Right-click on the scenario folder and select Send to.
            - Select Compressed zipped folder. Note, if you do not compress the folder before downloading it, the folder structure will not be maintained during the download. Each file will be downloaded individually and not within the folder.
        - Download your zipped scenario folder to your local machine.
            - Ctrl + drag the zipped folder to the Download Now folder in Frame Explorer. Note, dragging the file without pressing the Ctrl key moves the file and deletes it from the Cloud instance.
            - Your browser may ask you to confirm you want to allow the download from stkcloud.agi.com.
            - Hover over the download icon located in the bottom right-hand side to view the status of the download as "Preparing to Download" or "Downloading."
            - Once the download is complete, it will be saved on your local machine. It defaults to the "Downloads" folder.

Below you will find the exercises comprising of the **Scenario Development** portion of the exam. *This PDF is for your reference only.* Submit your answers via the custom link provided in your Level 2 - STK Master Certification Exam confirmation email.

Exercise 1: Aviator and Radar Capabilities

Prepare for Exercise 1

You can prepare for Exercise 3 by working through these lessons from the Level 2 – Advanced tutorials:

- Part 12: Introduction to Radar
- Part 14: Model Aircraft Missions with Aviator

Task 1.1

Use the *Aviator* capability to design a flight plan for an aircraft which flies cross country from Andrews AFB to Edwards AFB via NAVAID PUB (PUEBLO VORTAC, Pueblo, CO, USA).

- **NOTE**: Save Often!

1. Create a 24-hour scenario starting on 1 May 2024 17:00:00.000 UTCG.
2. Turn off Terrain Server.
3. Load the ARINC424 data files (FAANFD18) from the STK install area Using the Aviator Catalog Manager.
4. Insert EDWARDS AFB 04R 22L (runway) as a Place object using the Aviator Catalog Manager.
5. Insert an Aircraft object and name it MissionAcft.
    - Switch the propagator to Aviator.
        - Optimize STK for Aviator.
        - Use the Basic Airliner and all the default settings.
        - Set the Mission Wind Model using Constant Bearing/Speed, a Wind Bearing: of 270 deg and a Wind Speed of 20 nm/hr.
        - Reconfigure the aircraft by adjusting the initial fuel state to 100000 lbs.
    - Takeoff from runway ANDREWS AFB 01R 19L.
        - Use runway heading 011 Mag 000 True (Headwind).
        - Set the Runway Altitude Offset to 20ft.
        - Enable Use terrain for Runway Altitude.
    - After takeoff, switch to a Basic Maneuver procedure.
        - Use a Straight Ahead strategy.
        - Fly downrange 40 nm.
            - This should be the only stopping condition.
        - Change the Vertical / Profile altitude mode to use Specify Altitude Change.
        - Set the relative altitude change to 15000 ft.
    - Insert NAVAID PUB as a Place object using Aviator.
    - Fly to NAVAID PUB using the Basic Point to Point procedure.
        - Use Navigation Options - Nav Mode to fly direct to PUB.
    - Land at runway EDWARDS AFB 04R 22L.
        - Use runway heading 227 Mag 238 True (Headwind).
        - Set the Runway Altitude Offset to 20ft.
        - Enable Use terrain for Runway Altitude.
        - Enable Delay Enroute Climbs and Descents.

Task 1.1 questions

- Find answers to your questions:
  - Question 1: STK Help
  - Questions 2-4: Flight Profile by Time report / Step: 10 sec
  - Question 5: Aviator Catalog Manager

1. **Which of the following answers is correct concerning enabling Delay Enroute Climbs and Descents in Aviator?**

   a) The aircraft will fly directly to the procedure site from the end of the previous procedure, turning as necessary
   b) The aircraft begins climbing or descending at a point in time during the procedure such that it won't achieve the new altitude until the start of the arc or pattern, or until it has reached the procedure site.
   c) It forces the aircraft to maintain its cruise speed when climbing or descending, even if doing so will result in the aircraft making a turn large enough that it takes longer to complete than it would complete a slower, smaller turn.
   d) It is used to model coordinated flight between the aircraft and its formation vehicle.

2. **Approximately, how long does the flight take from takeoff at Andrews AFB to landing at Edwards AFB and coming to a complete stop?**

   a) 4 hours 19 min
   b) 4 hours 29 min
   c) 4 hours 39 min
   d) 4 hours 49 min

3. **The mission aircraft is overhead PUB at approximately 19:52:00. At that time, what is its approximate ground speed?**

   a) 155 nm/hr
   b) 414 nm/hr
   c) 480 nm/hr
   d) 503 nm/hr

4. **Approximately how much fuel was consumed during the mission?**

   a) 42067 lb
   b) 4300 lb
   c) 43067 lb
   d) 43081 lb

5. **What is the length of runway 01R / 19L at Andrews AFB?**

    a) 9500 feet
    b) 9755 feet
    c) 10005 feet
    d) 10100 feet

Task 1.2

Use the *Radar* capability to model a radar site at NAVAID PUB, determine when you can begin tracking the aircraft from Pueblo Memorial Airport, and determine the overall efficiency of your radar system.

6. Raise PUB's altitude an additional 50 feet above the ground.
7. Attach a Sensor object to PUB and name it Servo.
    - Change the Cone Half Angle to two (2) deg.
    - Target MissionAcft.
    - Set the maximum Elevation Angle constraint to 30 deg.
8. Attach a Radar object to Servo.
    - Set up the Antenna:
        - Use a Cosine Squared Aperture Rectangular antenna.
            - Set the X Dim Beamwidth to 5 deg.
            - Set the Y Dim Beamwidth to 1.4 deg.
            - Use a design frequency of 2.4 GHz.
            - Set the Main-lobe Gain to 34 dB.
            - Set the Efficiency to 55%.
    - Set up the Transmitter:
        - Set the transmitter frequency to 2.4 GHz.
        - Set the power to 25 kW.
9. Set MissionAcft's radar cross section.
    - Use a Constant RCS Value of 20 dBsm.
10. Compute an Access between the Radar object and MissionAcft.

Task 1.2 questions

- Find answers to your questions:
    - Questions 6, 8 and 9: Radar SearchTrack report / Step: 5 sec
    - Questions 7 and 10: Radar SearchTrack and AER reports / Step: 5 sec

6. **Basing a probability of detection on an S/T Integrated PDet value of 0.8 or higher, approximately what time can you be certain of first tracking the aircraft?**

    a) 17:43:00
    b) 18:43:00
    c) 19:43:00
    d) 20:43:00

7. **When the aircraft is outbound from PUB, what is the approximate distance from the radar to the aircraft when the S/T Integrated PDet value drops below 0.8?**

    a) 141 km
    b) 151 km
    c) 161 km
    d) 171 km

8. **What is the approximate S/T Integrated Signal to Noise Ratio (SNR) when an S/T Pulses Integrated value of 1 is first achieved?**

    a) 16 dB
    b) 18 dB
    c) 19 dB
    d) 20 dB

9. **Basing a probability of detection on an S/T Integrated PDet value of 0.8 or higher and not considering the time the aircraft is in the radar's cone of silence, what is the approximate length of time the radar can track the aircraft? Round times up or down as needed.**

    a) 10 min
    b) 13 min
    c) 17 min
    d) 21 min

10. **Basing a probability of detection on an S/T Integrated PDet value of 0.8 or higher, what is the approximate elevation angle of the aircraft from the radar site the first time 0.8 is achieved?**

    a) 3.3 deg
    b) 3.6 deg
    c) 3.9 deg
    d) 4.2 deg

Exercise 2: STK Pro, Astrogator, and Communications Capabilities

Prepare for Exercise 2

You can prepare for Exercise 2 by working through these lessons from the Level 2 – Advanced tutorials:

- Part 6: Introduction to the Pro Capabilities
- Part 11: Introduction to Communications
- Part 16: Design Trajectories with Astrogator

Task 2.1

Use the Ansys STK/Astrogator® capability to propagate a Satellite object into a medium earth orbit.

- **NOTE**: Save Often!

1. Create a three (3)-day scenario starting on 1 May 2024 06:00:00.000 UTCG.
2. Turn off Terrain Server.
3. Insert RaistingStation.pdtt as analytical and visual terrain using Globe Manager.
   - The RaistingStation.pdtt file is located in:
     - STK 12: C:\Program Files\AGI\STK 12\Data\Resources\stktraining\imagery
4. Insert a default Satellite object and name it CommSat.
   - Select Astrogator as the propagator.
   - Change the existing Initial State Segment in the Mission Control Sequence (MCS).
     - Use Keplerian coordinates.
     - Set the following:
       - Semi-major axis: 7000 km
       - Eccentricity: 0.0001
       - Inclination: 55.5 deg
       - Right Asc. of Asc. Node: 180 deg
   - Change the existing Propagate Segment.
     - Create a new Apoapsis stopping condition.
     - Turn off the existing Duration stopping condition.
   - Run Entire Mission Control Sequence.
5. Raise the Apoapsis.
   - Add a Target Sequence after the existing Propagate Segment.
     - Name it RaiseApoapsis.
     - Nest a Maneuver segment to RaiseApoapsis.
     - Nest a Propagate segment after the new Maneuver segment.
     - Configure the Maneuver so that the Delta-V Magnitude is the control parameter.
     - Configure the new Propagate Segment.
       - Create a new Apoapsis stopping condition.
       - Turn off the existing Duration stopping condition.
       - Set the Keplerian Element - Altitude of Apoapsis as the result.
     - Configure RaiseApoapsis to use a Differential Corrector.
       - Enable the Control Parameter and the Equality Constraints.
       - Set the desired Apoapsis altitude result to 22000 km.
     - Change the Action to Run active profiles.
   - Run Entire Mission Control Sequence.

6. Raise the Periapsis.
   - Add a new Target Sequence prior to the bottom return segment.
     - Name it RaisePeriapsis.
     - Nest a Maneuver segment to RaisePeriapsis.
     - Nest a Propagate segment after the new Maneuver segment.
     - Configure the Maneuver so that the Delta-V Magnitude is the control parameter.
     - Configure the new Propagate Segment.
       - Create a new Periapsis stopping condition.
       - Turn off the existing duration stopping condition.
       - Set the Keplerian Element - Altitude of Periapsis as the result.
     - Configure RaisePeriapsis to use a Differential Corrector.
       - Enable the Control Parameter and the Equality Constraints.
       - Set the desired Periapsis altitude result to 22000 km.
     - Change the Action to Run active profiles.
   - Run Entire Mission Control Sequence.
7. Remove iterations from the 3D Graphics window.
   - Insert a Propagate Segment before the last return segment.
   - Run Entire Mission Control Sequence.

Task 2.1 questions

- Find answers to each question:
  - Questions 11-13: Generate a summary report in the MCS for RaiseApoapsis
  - Questions 14-15: STK Help

11. What was the approximate Delta-V Magnitude used to raise the Apoapsis to 22000 km?

a) 1.0 km/sec
b) 1.5 km/sec
c) 2.0 km/sec
d) 2.5 km/sec

12. What is the approximate amount of estimated fuel used for the maneuver?

a) 496 kg
b) 486 kg
c) 476 kg
d) 466 kg

13. What is the approximate estimated burn duration for the maneuver?

a) 2902 sec
b) 2907 sec
c) 2912 sec
d) 2917 sec

14. What is the purpose of setting the Action to Run active profiles?

a) It runs the mission control sequence allowing the active profiles to operate.
b) It runs the profile with corrections applied to control parameters.
c) It runs the mission control sequence.
d) It resets the controls of the search profiles to the segments' values.

15. How does Astrogator calculate an impulsive maneuver?

a) It is effectively a Propagate segment with thrust by using the defined propagator to propagate the state, accounting for the acceleration due to thrust.
b) After you select the thrust magnitude, Astrogator computes the thrust attitude and, optionally, the maneuver duration in order to optimize a certain objective function and meet a set of constraints.
c) It calculates the new state of the spacecraft by adding a Delta-V vector to the final state velocity of the previous segment.
d) It models the movement of the spacecraft along its current trajectory until meeting specified stopping conditions.

Task 2.2

Use the STK Communications capability to determine the health of a link budget between the CommSat and a Place object.

8. Attach a Transmitter object to CommSat and name it DLTx.
   - Use the default Simple Transmitter Model.
     - The transmitter frequency is 1.5 GHz.
     - The Effective Isotropic Radiated Power (EIRP) is 200 W.
9. Insert a default Place object and name it Raisting.
   - Raisting is located at:

Latitude	Longitude
47.8982 deg	11.10822 deg

   - Raise Raisting an additional 30 feet above ground.
   - Define an azimuth-elevation mask that allows you to use the RaistingStation.pdtt analytically.
   - Consider the maximum range out to 160 km.
   - Use the azimuth-elevation mask for access constraints.
10. Attach a Receiver object to Raisting and name it DLRx.
    - Use the Simple Receiver model.
    - Constrain the Receiver object to use Raisting's Az-El Mask.
11. Create a simple link budget from DLRx to DLTx.

Task 2.2 questions

- Find answers to each question:
  - Question 16: Link Budget report / Step: 60 sec

16. Do you have any BER values greater than 1.000000e-009?

a) Yes
b) No

Continue building Task 2.2

12. Leave the simple link budget open.
13. Change DLRx's gain divided by the system noise temperature (G/T) to 17 dB/K.
14. Refresh your link budget.

Task 2.2 questions continued

- Find answers to each question:
  - Question 17: Link Budget report
  - Questions 18 and 20: Link Budget - BER and AER reports / Step: 60 sec
  - Question 19: AER report / Step: 60 sec

17. Do you have any BER values greater than 1.000000e-009?

a) Yes
b) No

18. When the first instance that your BER is greater than 1.000000e-009, what is the approximate range from the Place object to the Satellite object?

a) 25175 km
b) 25207 km
c) 25239 km
d) 25270 km

19. When the Transmitter object has Access to the Receiver object, approximately, what is the closest range between the two objects?

a) 1118 km
b) 1089 km
c) 1038 km
d) 1148 km

20. What is the approximate Elevation angle between the Transmitter object and the Receiver object when the BER in the Link Budget - Detailed report is highest?

a) 0.6 deg
b) 0.7 deg
c) 0.4 deg
d) 0.8 deg

Exercise 3: STK Pro and Coverage Capability

Prepare for Exercise 3

You can prepare for Exercise 3 by working through these lessons from the Level 2 – Advanced tutorials:

- Part 6: Introduction to the Pro Capabilities
- Part 8: Compute Coverage Over Regions

Task 3.1

Three satellites will be placed in orbit each containing a camera identical to the other two satellites. All three will cover the Earth twenty-four hours a day. Your task is to determine how well three cameras attached to the satellites cover the entire Earth.

- **IMPORTANT**: Use STK Help to determine task UI settings and to answer UI questions.

- **NOTE**: Save Often!

1. Create a 24-hour scenario starting on 1 May 2024 16:00:00.000 UTCG.
2. Disable Terrain Server.
3. Insert three Satellite objects using the Orbit Wizard:
   - Satellite 1:
     - Orbit type is Circular.
     - Name the satellite C_Sat.
     - Set the inclination to 60 deg.
     - Set the altitude to 700 km.
   - Satellite 2:
     - Orbit type is Repeating Ground Trace.
     - Name the satellite R_Sat.
   - Satellite 3:
     - Orbit type is Sun Synchronous.
     - Name the satellite S_Sat.
4. Insert rectangular Sensor objects on each satellite.
   - Set the vertical half angle to 20 deg.
   - Set the horizontal half angle to 15 deg.
5. Rename the Sensor objects:

Satellite	Sensor Name
C_Sat	C_Camera
R_Sat	R_Camera
S_Sat	S_Camera

6. Insert a Coverage Definition object.
   - Use a Global grid area of interest.
   - Set the Point Granularity, using latitude and longitude, to 4 deg.
   - Assign all three cameras as the coverage assets.

- Turn off Automatically Recompute Accesses.

7. Compute Coverage Access.
8. Attach a Figure of Merit object to the Coverage Definition object.
   - Measure the quality of coverage using Simple Coverage.

Task 3.1 questions

- Find answers to each question:
  - Question 21: STK Help
  - Question 22: Percent Satisfied report

21. Which statement is true concerning Simple Coverage?

a) Measures the number of coverage gaps found over the interval of the coverage definition.
b) Measures the time between the end of a coverage interval and the current time.
c) Measures whether or not a point is accessible by any of the assigned assets.
d) Measures the intervals during which coverage is not provided.

22. What is the approximate percentage of the Earth's surface covered by all three cameras?

a) 77
b) 80
c) 72
d) 86

Continue building Task 3.1

9. Change the Figure of Merit to measure the quality of coverage using Number of Accesses.
   - Compute the total number of accesses over the entire coverage interval.

Task 3.1 questions continued

- Find answers to each question:
  - Question 23: Grid Stats report
  - Question 24: Value By Grid Point report

23. What is maximum number of accesses seen over the analysis period?

a) 4
b) 6
c) 8
d) 10

24. **How many times was the grid point located at latitude -46.000 degrees and longitude 231.818 degrees accessed?**

    a) 7
    b) 2
    c) 5
    d) 4

Continue building Task 3.1

10. Change the Figure of Merit to measure the quality of coverage using Coverage Time.
    - Compute the amount of time (over the entire coverage interval) during which a point is covered by at least the specified number of assets based on the entire coverage interval.

Task 3.1 questions continued

- Find answers to each question:
    - Question 25: Value By Latitude report

25. **Which latitude contains the highest maximum of coverage time?**

    a) 82.000 deg
    b) 58.000 deg
    c) -58.000 deg
    d) -82.000 deg

Task 3.2

R_Sat is tasked with providing coverage of Canada, Mexico and the Continental United States when those countries are covered by total sunlight. Determine how well R_Sat's camera covers the three countries during daylight.

11. Insert three (3) Area Target objects that cover the primary area only of the following countries:
    - Canada
    - Mexico
    - United States of America
12. Update the Coverage Definition object.
    - Use all three Area Target objects as the grid areas of interest.
    - Set the Point Granularity, using latitude and longitude, to 0.5 degrees.
    - De-assign the C_Camera and S_Camera assets.
13. Compute Coverage Access.
14. Change the Figure of Merit to measure the quality of coverage using Access Duration.
    - Compute the average duration of all access intervals over the entire coverage interval.

Task 3.2 questions

- Finding answers to your questions:
    - Question 26: STK Help
    - Question 27: Grid Stats report

26. Which statement is true concerning Access Duration?

a. Measures the intervals during which coverage is not provided.
b. Measures the time between the end of a coverage interval and the current time.
c. Detects periods of time when grid points have multiple access periods within a specified time range of each other.
d. Measures the intervals during which coverage is available from a single asset.

27. What is the approximate average access duration of all access intervals over the entire coverage interval?

a. 14 seconds
b. 18 seconds
c. 21 seconds
d. 23 seconds

Continue building Task 3.2

15. Apply a Direct Sun constraint over the entire coverage grid.
16. Compute Coverage Access.

Task 3.2 questions continued

- Finding answers to your questions:
    - Question 28: Grid Stats report
    - Question 29: Value By Longitude report
    - Question 30: Stats By Region

28. What is the approximate average access duration of all access intervals over the entire coverage interval?

a. 14 seconds
b. 13 seconds
c. 12 seconds
d. 11 seconds

29. What is the approximate average access duration along the longitude 300.000 degrees?

a. 34 seconds
b. 37 seconds
c. 40 seconds
d. 43 seconds

30. What is the approximate average access duration for Canada?

a. 9 seconds
b. 18 seconds
c. 21 seconds
d. 6 seconds

Exercise 4: STK Pro, Communications, Coverage and Analysis Workbench

Prepare for Exercise 4

You can prepare for Exercise 4 by working through these lessons from the Level 2 – Advanced tutorials:

- Part 6: Introduction to the Pro Capabilities
- Part 7: Customize Analysis with Analysis Workbench
- Part 8: Compute Coverage Over Regions
- Part 11: Introduction to Communications

Task 4.1

Test launch a sounding rocket at a test range. Determine through a link budget how well a communications ground site receives data from the rocket. Using the *Coverage* capability, investigate the location inside the test range where the carrier to noise ratio will be lowest. Propagate a surveillance satellite. Use the *Analysis Workbench* capability to load two To Vectors and create an angle between the vectors. Determine what time the rocket is at its apogee and what the angle is between the vectors at that time and the distance from the rocket to the communication ground site. Determine the ground distance between the rocket's launch and impact points.

- **IMPORTANT**: In the STK application, when placing ground objects at locations east of the Prime Meridian (Latitude 0 deg and Longitude 0 deg), longitudes are positive until they reach the Anti-Meridian (Latitude 0 deg and Longitude 180 deg) at which time they become negative until you return to the Prime Meridian. Some reports in the STK software use longitudinal values of 0 to 360 degrees. Nothing is wrong. For instance, if an object is placed at -90 degrees longitude, some reports will convert that to 270 degrees longitude. Reports and questions in Exercise 4 will use negative longitude values.

- **NOTE**: Save Often!

1. Create a 5-minute scenario starting at 1 May 2024 18:00:00.000 UTCG.
2. Disable Terrain Server.
3. Insert an Area Target object using the Area Target Wizard and set the following:
   - Name: TestZone
   - Set the following boundary points:

Latitude	Longitude
33.82 deg	-106.75 deg
33.82 deg	-106.1 deg
32.1 deg	-106.1 deg
32.1 deg	-106.75 deg

4. Insert a Missile object and name it TestMissile.
   - TestMissile's launch location is:

Latitude	Longtitude
32.41795 deg	-106.3215 deg

   - The launch altitude is 20 feet.
   - Set a fixed apogee altitude flight parameter of 100 kilometers.
   - TestMissile's impact location is:

Latitude	Longtitude
33.3421 deg	-106.31 deg

   - The impact altitude is 20 feet.
5. Attach a Transmitter object to TestMissile and name it DLTx.
   - Use a simple transmitter model.
     - The transmission frequency is 2.4 GHz.
     - The transmitter's EIRP is 1 dBW.
     - Set the data rate to 15 Mb/sec.
6. Insert a Place object and name it CommSite.
   - CommSite's location is:

Latitude	Longtitude
32.9587 deg	-106.5195 deg

   - Raise CommSite 10 feet above the ground.
7. Attach a Sensor object to CommSite and name it Servo.
   - Define Servo's field of view using a type that models a parabolic antenna.
     - Set the frequency to 2.4 GHz.
     - Set the diameter to 0.5 m.
   - Target TestMissile.
     - Set the Track Mode to Receive.
8. Attach a Receiver object to Servo and name it DLRx.
   - Use a complex receiver model.
   - Use a parabolic antenna model.
     - The antenna's design frequency is 2.4 GHz.
     - The antenna's diameter is 0.5 m.
9. Compute an Access from DLRx to DLTx.

Task 4.1 questions

- Find answers to each question:
  - Question 31- 32: Link Budget - BER report / Step: 5 sec
  - Question 33: Altitude vs Ground Range report for the Missile / Step: 5 sec

31. Approximately, what is your worst Bit Error Rate (BER)?

a) 8.2e-10
b) 1.0e-30
c) 2.0e-10
d) 2.2e-09

32. What time does the BER first climb above 1.0999999e-9?

a) 18:00:00.000
b) 18:02:00.000
c) 18:02:45.000
d) 18:01:55.000

33. At what time does TestMissile reach apogee?

a) 18:02:25.000
b) 18:03:10.000
c) 18:03:30.000
d) 18:03:45.000

Continue building Task 4.1

10. Insert a Coverage Definition object.
    - Use TestZone as the grid area of interest.
    - Set the grid points to a distance of 2 km apart.
    - Use DLRx as the grid constraint.
    - Set the Point Altitude to 10 ft above the WGS84.
    - Assign the DLTx as the coverage asset.
11. Compute Coverage Access.
12. Attach a Figure of Merit object to the Coverage Definition object.
    - Measure the quality of coverage using an Access Constraint type.
    - Set the constraint to measure the carrier to noise ratio (C/N).
    - Compute the maximum C/N value for the static definition of the FOM.
    - Sample the coverage in 5-second increments.
13. Return to the Report & Graph Manager.
    - Change the Object Type to FigureOfMerit.
14. Generate a Grid Stats Over Time report.
    - Be patient because it could take a couple of minutes.
    - Ensure the step size is set to 5 sec.
    - Any invalid data indicator values reported as -9999.990 simply means that test missile is no longer in the scenario.

Task 4.1 questions

- Find answers to each question:
  - Question 34: Grid Stats Over Time and Altitude vs Ground Range reports
  - Question 35: Value By Grid Point At Time report

34. What is the approximate minimum C/N reported when TestMissile is at apogee?

a) 5.5 dB
b) 6 dB
c) 6.5 dB
d) 26 dB

35. Based on the time selected in question 33, at what latitude and longitude is the lowest C/N dB reported?

a) Latitude 33.812 Longitude 253.262
b) Latitude 33.812 Longitude 253.286
c) Latitude 33.812 Longitude 253.310
d) Latitude 33.797 Longitude 253.262

Continue building Task 4.1

15. Insert the satellite SBIRS GEO-4 (USA 273) into the scenario.
    - Use the From Standard Object Database method.
    - Use AGI's Standard Object Data Service as the data source.
16. Display Vectors on TestMissle.
    - Add the following To Vectors to TestMissle's 3D Graphics – Vector page vectors list:
      - CommSite
      - SBIRS_GEO-4_USA_273_41937
    - Display both vectors in the 3D Graphics window.
    - Display the magnitude of the vector pointing at CommSite in the 3D Graphics window.
17. Use the Vector Geometry Tool to create an angle between the To Vectors.
    - Add the angle to TestMissle's 3D Graphics – Vector page angles list.
    - Ensure show angle value is enabled.
18. Set the scenario time to when TestMissile is at apogee.
19. Bring the 3D Graphics window to the front.
20. Zoom To TestMissile.

Task 4.1 questions continued

- Find answers to each question:
  - Questions 36 and 37: STK Help
  - Questions 38 and 39: 3D Graphics window
  - Question 40: Altitude vs Ground Range report

36. Which answer is correct concerning a To Vector?

a) It is defined as a projection of a specified vector onto a direction of reference vector.
b) It is based on another vector fixed at a specified epoch.
c) They are automatically generated by STK for all objects in your scenario.
d) They are defined along the intersection of two planes.

37. Which answer describes the purpose of Show Magnitude in the 3D Graphics - Vector page?

a) It displays the magnitude (distance) value on the selected geometric element.
b) It displays vectors at their true length.
c) It displays a text label with the selected geometric element.
d) It changes the size of the 3D Graphics model.

38. What is the approximate angle value between the To Vectors at apogee?

a) 148 deg
b) 145 deg
c) 155 deg
d) 152 deg

39. At apogee, what is the approximate distance from TestMissile to CommSite?

a) 99 km
b) 100 km
c) 101 km
d) 102 km

40. What is the approximate ground distance between TestMissile's launch point and impact point?

a) 99 km
b) 100 km
c) 101 km
d) 102 km