Project 1
STK Level 1 Certification

The deadline for submitting this project is the **9th November, 2023, 11:59**.

Important Update!

We have been informed that some students are having problems registering for the STK Level 1 Certification Test. They received the following text by email and then never received a response nor got access to the detailed certification exercises:

> *Thank you for your interest in becoming STK Certified. We are required to obtain approval from your local representative. We have forwarded your request and are awaiting a response. If you are approved, we will let you know so that you can proceed with registration.*

Therefore, we have made the following two changes to this project description:
(a) The STK Level 1 Certification Exercises are now appended at the end of this document.
(b) You do not have to officially register at AGI for the certification and submit your solutions to them, but it suffices to only upload them to your *personal status page* in dCMS before 9th November, 2023, 11:59.

During this project, you will familiarise yourself with the basic functionality of STK. AGI provides training material introducing the features one after another, concluded by a final certification test. The project essentially consists of completing these.

1 Submission Instructions

In order to pass the project, you need to fulfil the following requirements:

- You ~~must~~ **may** hand in the certification to AGI by e-mail before the deadline mentioned above.
- You ~~must~~ **may** include `stock@depend.uni-saarland.de` in `(B)CC` when writing to the certification team.
- You **must** upload your solution to the dCMS before the deadline.
- You **must** pass the certification test as judged by AGI or us.
- You ~~must~~ **may** forward the grading e-mail from AGI to `stock@depend.uni-saarland.de` before the **23rd November, 2023, 23:59** (you may censor private information like your shipping address). The certification team of AGI usually grades submissions within 5 business days. If you have not heard from AGI before the deadline, please let us know via a message to **@Assistants** in our *discussion board*.

2 Preparations

Throughout the projects, we will use STK. To obtain your copy of STK and complete this project successfully, you need to register yourself at `agi.com`. You must use the **same** e-mail address you used for the dCMS.

2.1 Installing STK

Unfortunately, STK only runs on Windows. If you are not using Windows or do not want to install STK yourself, you can download a preconfigured VM provided by us. Please go directly to Section 2.2.

(a) To download STK, please visit `support.agi.com/downloads`. If not logged in yet, you need the account you created above. Download the *Systems Tool Kit (STK) Pro* variant of version *12.7.1*.

(b) Extract the archive and start the `install.exe` executable in the `STK_v12.7.1` subdirectory.

(c) Select the software you want to install and click *Start Installation*. Keeping the default selections is recommended. The install program will step you through installing the software applications you selected. Click *Finish* once the installation completes.

(d) Start STK. Confirm the launch of the *Ansys Licensing Client Settings* and go to `FlexNet Publisher > License servers`. Add a new license server with "Server 1": `agilicsrv.cs.uni-saarland.de` and "Port": `27010` (leave "Server 2/3" empty). You can click the "Test" button on the right to check the connection to our license server. After you activated STK, you can start completing the upcoming exercises.

Caution: You need to be connected to the university network to use the license, either directly or using a VPN connection.

Hint: You may also have a look at the official STK installation instructions at `help.agi.com/stk/index.htm#install/installingSTK.htm`.

2.2 Downloading the Virtual Machine

In order to use the virtual machine, you need VirtualBox 7.0.10. Download the virtual machine from the *Materials* section of the dCMS. We already took care of installing STK and configuring our license server. Note that you need to be connected to the university network to use the license, either directly or using a VPN connection. We recommend establishing such connection on your host machine and not inside the VM.

3 STK Training

Please complete the following *Level 1 – Beginner Training* exercises.

Exercise P1.1 *(STK Lesson One)*
Complete the *Build Scenarios* STK tutorial.

Exercise P1.2 *(STK Lesson Two)*
Complete the *Objects and Properties* STK tutorial.

Exercise P1.3 *(STK Lesson Three)*
Complete the *Access Reports and Graphs* STK tutorial.

Exercise P1.4 *(STK Lesson Four)*
Complete the *Movies and Visual Data Files* STK tutorial.

Exercise P1.5 *(STK Lesson Five)*
Complete the *Introduction to Connect* STK tutorial.

4 STK Certification

Exercise P1.6 *(STK Level 1 Certification)*
Complete the *STK Level 1 Certification Test*.

(a) Register for *Level 1: STK Certification* at `agi.com/training-and-certification` using the account you created above.

(b) After successful registration, you receive the detailed task description. **Update:** If you are having problems registering, please refer to the detailed task description on the next page instead.

(c) Please follow the instructions there. You can ignore the parts that are specific to "STK Cloud".

(d) Do not forget the additional requirements explained in Section 1.

LEVEL 1 CERTIFICATION

STK Certification

AGI

Instructions:

1. **If required, install the most current version of STK:** Download STK, then install and license it on your computer (Free version). You can take this test using the web-based STK Cloud which does not require an install or license.
    a. Note: If you want to use STK Cloud to take this Certification test and do not have access to the STK Cloud Trial, please email certification@agi.com to help gain access.
2. **Complete Training:** Complete the Level 1 - Beginner Training.
    a. Online at start.agi.com.
    b. Locally in the STK Help under "STK > Training > Level 1 – Beginner Training".
3. **Complete the Certification Exercise:** Complete all scenario steps and tasks for each section.
    ** This test must be completed independently and must be **your own work**.*
4. **Submit your Certification Test:** Upload the scenario to the AGI File Transfer Server.
5. **Email:** Send an email to certification@agi.com with the scenario folder name and STK version used.

** **Please Note:** Once you submit your test, we will grade it and get back to you within 5 business days. If you have a special circumstance, please let us know and we will try our best to accommodate your request.*

Level 1 Certification Exercise:

On October 28, 2011, a 6.9-magnitude earthquake hit the central coast of Peru, destroying several homes and injuring dozens. Due to the number of recurring damaging earthquakes in the area, future aircraft and satellite systems are being considered to provide timely damage assessment to nearby cities. Use STK to model these systems and evaluate various aspects of their missions. Historical earthquake data is provided and will be the basis for this exercise.

Section 1: Create a New Scenario

Scenario steps:

1. Create a new scenario starting at the time of the Earthquake, and ending five hours later.
    Name: "STK_Cert_FirstNameLastName_STKVersion" e.g. STK_Cert_JohnSmith_V12
    Start: 28 Oct 2011 18:54:00 UTCG
    Stop: 28 Oct 2011 23:54:00 UTCG
2. Save your scenario.
    - If you are using STK Desktop: save your scenario to your computer's File Directory (e.g. Documents > STK 12). A folder with the same name as your scenario is created for you in the location specified in the Create a Scenario Window.
    - If you are using STK Cloud: save your scenario to your user area on the STK Data Federate (SDF). You cannot directly save scenarios from STK Cloud to your local drive.

- Open File – Save To STK Data Federate. If you are not logged in to the SDF, click guest in the upper right corner, and select Switch User.
- Enter your agi.com credentials into the Account and Password fields.
- Select your personal SDF account directory (UserHomes/xxx@email.com), and Add a New Folder with the same name as your scenario.
- Choose Scenario Files (*.sc) as the Save as type.
- Click Save and Check In when done.

**If you are using STK Desktop, save any Task files to the folder you just created. If you are using STK Cloud, alternate methods for saving files will be listed within the Task after the words "STK Cloud:".*
Note: Save Often!

3. Disable the Terrain Server on the Scenario – Properties, Basic – Terrain page.
4. The coordinates of the nearest runway to the epicenter are provided in the table below. They outline the runway. Create an Area Target object called "Runway" based on these Lat / Lon values for the perimeter points:

Latitude	Longitude
-12.1501 deg	-76.9957 deg
-12.1711 deg	-77.0026 deg
-12.1713 deg	-77.0022 deg
-12.1503 deg	-76.9953 deg

4. To account for the local surroundings, add a 2 deg elevation angle constraint to Runway.
5. The city hit hardest by the 2011 earthquake was Ica, Peru.
   - Insert Ica as a Place object (- 14.0639 deg, -75.7303 deg).
6. Another hard-hit city was Paracas, Peru.
   - Insert Paracas as a Place object (-13.849 deg, -76.255 deg).
7. Re-orient the 3D Graphics Window to view the Quake Region. Ensure you can see Ica, Paracas, and the Runway.

Tasks:

T1. Create a stored view of the Quake Region from the last scenario step performed called "Quake Region."
T2. Add the lighting intervals for Ica to the Timeline View.
T3. Create a custom report that shows the latitude and longitude of Ica and save it as a Quick Report called "Ica_LatLon".

Section 2: Model the Aircraft System

Scenario steps:

8. Create a new Aircraft object called "CertAircraft", and ensure the Propagator is set to Great Arc.
9. Use 3D Object Editor Toolbar or enter the Lat / Lon values for the following waypoints:
   1. Runway (use the centroid only and use a constant altitude of 10,000 ft)
   2. Paracas
   3. Ica

4. Runway (use the centroid only)

10. Set each waypoint's turn radius to 1 km.
11. Change the route color to white and make the route line width one level thicker.
12. Zoom to CertAircraft.
13. Change CertAircraft's 3D model to the "uav.mdl" model.
14. Use the coordinated turn attitude type to model the banking of CertAircraft.
15. Create a Sensor object called "AC_Camera" which has a Rectangular 100x100 deg field of view and attach it to CertAircraft. Note, this is the actual field of view; Rectangular Sensors are defined in STK by vertical and horizontal half-angles.

Tasks:

T4. Create a custom report for CertAircraft called "FlightSummary" that includes the following groups, data providers and elements. Then save it as a .csv file. Click OK to close the Information pop-up window:

Time (Set the units to EpSec)
LLA State-Fixed-Lat
LLA State-Fixed-Lon
LLA State-Fixed-Alt
Heading-Fixed-Azimuth
Heading-Fixed-Elevation
Heading-Fixed-Velocity

- STK Cloud: Save the .csv file to your scenario folder on the STK Data Federate (SDF) and Check In when done.

T5. Create an Access report to determine if CertAircraft has line-of- sight access to Runway for its entire route and save it as a Quick Report called "Aircraft_to_Runway".

T6. Using X Real-time Animation Mode ( ) create a ten to fifteen second STK video of CertAircraft flying over Ica called "AircraftView.wmv."

- STK Cloud:
  - Save the movie to the Documents folder on the STK Cloud session.
  - After the movie records, click the gear icon  at the bottom left corner of the STK Cloud browser window, and select Google Chrome.
  - Go to https://sdf.agi.com/, and enter your agi.com account information into the Account and Password fields.
  - Click on My Files, then select your scenario folder.
  - Click Upload, then click the Select files to upload button.
  - Navigate to Documents on the left, select your Movie (.wmv), and click Open. The movie is now uploaded to your scenario folder on the SDF. Keep the Google Chrome window open. You will come back to this later.
  - Click the gear icon  at the bottom left corner of the STK Cloud browser window, and select your STK scenario.

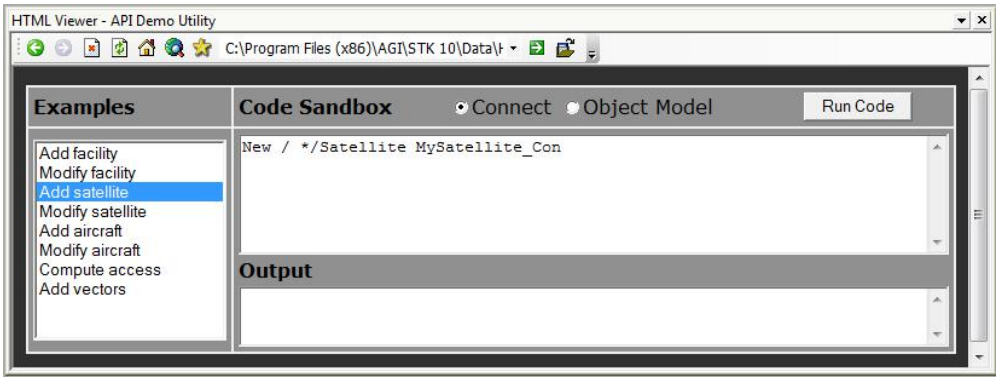
Note: Recording the movie with the Movie Timeline Tool will automatically change the animation time period. After recording the video, set the animation start and stop times to the entire scenario period (Scenario – Properties > Basic – Time).

T7. Increase CertAircraft's altitude so it maintains line-of-sight to Runway for the entire flight.

Section 3: Model the Satellite System

Scenario steps:

16. Use STK Connect to create a Satellite object named "CertSatellite", and add the connect command to the Scenario Description – Long Description field.
    Hint: Refer to the "Task 6.2: Use the examples to familiarize yourself with Connect" on start.agi.com
    Also available as an installed Example HTML utility
    i. STK 11 32-bit: C:\Program Files (x86)\AGI\STK 11\Data\HtmlUtilities\STK Automation\API Demo
    ii. STK 11 64-bit: C:\Program Files\AGI\STK 11\Data\HtmlUtilities\STK Automation\API Demo



17. Use STK Connect to change the Inclination of CertSatellite to 15 deg, and add the connect command to the Scenario Description – Long Description field.
    Hint: Search for "SetState Classical" in the STK Help
18. Change CertSatellite's 3D model to the "cubesat_3u.dae" model. If you do not have STK V 11.1 or higher, you can download the file from this FAQ.
19. Create a Sensor object called "Sat_Camera" which has a Simple Conic 60 deg field of view and attach it to CertSatellite. Note, this is the actual field of view; Simple Conic Sensors are defined in STK by Cone Half Angles.
20. Zoom to CertSatellite and set the animation time to when the Sat_Camera first accesses Ica.

Tasks:

T8. Using Snap Frame, create a .bmp of CertSatellite from the last scenario step performed ~~20~~ called "SatView.bmp."

- STK Cloud:
  - Save the snap to This PC > Documents folder on the STK Cloud session.
  - Click the gear icon  at the bottom left corner of the STK Cloud browser window, and select Google Chrome > STK Data Federate.
  - You should return to scenario folder on the SDF. If not, click My Files, then select your scenario folder.
  - Click Upload, then click the Select files to upload button.
  - Navigate to Documents on the left, select SatView.bmp, and click Open. The snap is now uploaded to your scenario folder on the SDF.

- Click the gear icon  at the bottom left corner of the STK Cloud browser window, and select your STK scenario.

T9. Create an Access report that shows the azimuth, elevation and range (AER) from Sat_Camera to Ica and save it as a Quick Report called "SatCamera_to_Ica".

T10. Add Access Intervals to the Timeline View to determine which vehicle's camera can see Ica first and the longest.

Section 4: Submit your Certification Test

Scenario steps:

21. Save your scenario.
    - STK Cloud: When you click Save, the Save As window will pop up. Ensure your scenario folder is selected on the STK Data Federate (SDF). Select Scenario Files (&.sc) for the Save as type:, then click Save, and Check In.
22. Make sure all task output files (snaps, reports, video) are saved in your scenario folder.
23. Zip up your Scenario folder.
    - STK Cloud:
        - In a web-browser on your local machine, log in to https://sdf.agi.com/ using your agi.com account Username and Password.
        - Click on My Files, and locate your STK Certification scenario folder.
        - Click Download as Zip on the right-hand side.
24. Post your zipped folder to the AGI File Transfer Server:
    https://files.agi.com
    Login ID: certtest
    Password: 2MB953BT

    * ***PLEASE NOTE:***
    You may see the following information dialog: *"Some browsers may not allow the upload of files larger than 4 GB."* This is a warning and does not mean there is an error with your upload.
    This folder is a blind folder. Once you upload your file, you and others will not be able to see it.
25. Send an email to certification@agi.com with the name of your scenario folder and the STK version used.