

# How to Conduct an Investigation

In an investigation, students conduct inquiry-based explorations of ISS EarthKAM, and possibly other, images of Earth. An investigation is the process of analyzing and asking questions about the images and what they show. In short, the images should serve as a source of both information and inspiration.

An ISS EarthKAM investigation should be inquiry-based, but it can still be responsive to the needs of your students, classroom, and curriculum. This guide outlines the various aspects of an investigation and provides suggestions and materials to support you as your students conduct their investigations.

## Materials/Resources:

- Arrange access to the ISS EarthKAM Web site, to hardcopies of ISS EarthKAM images and Metadata, or to other images of Earth and their accompanying data.
- Review the other How To educator guides, including How to Explore Images, How to Annotate an Image, and How to Locate an Image on a Map.
- Make photocopies of the Exploring Images Worksheet or Exploring Images Online Worksheet.
- Gather the necessary materials: Annotation materials (for hardcopy or electronic images), atlases, maps, and resources for exploring the images and pursuing research question(s), such as travel guides and reference books.

**Time:** 3+ (50 minute) periods

**Level:** Intermediate/Advanced

## Recommended Procedures:

### Defining and Planning the Investigation

Defining and planning an investigation is part of the investigation process. This means that, as much as is feasible, your students should be involved. The more you can include them, the more committed they will be to making it successful.

#### 1. Select a Topic

While selecting a topic, consider your curriculum priorities and your local and state frameworks. ISS EarthKAM supports explorations in science, geography, mathematics, and technology.

## STANDARDS

### Science

#### Science as Inquiry

- Abilities necessary to do scientific inquiry.
- Understandings about scientific inquiry.

#### History and Nature of Science

- Science as a human endeavor.

### Geography

#### The World in Spatial Terms

- Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information.
- Standard 3: How to analyze the spatial organization of people, places, and environments on Earth's surface.

## EDUCATOR GUIDES

The educator guides referenced throughout this document are available in the Educator section of the ISS EarthKAM Web site:

<http://www.earthkam.ucsd.edu/public/educators>



Also consider the nature of the images; ISS EarthKAM images are more appropriate for some topics than for others. In general, good topics include:

- specific Earth features (e.g. the nature of rivers, mountains, oceans, lakes, deserts, or coasts),
- human-environment interactions (e.g. cities, agriculture, transportation),
- weather (e.g. cloud patterns, conditions at extreme latitudes),
- geoscience (e.g. interactions between human beings and their environment, natural and artificial boundaries, physical processes),
- location specific studies (e.g. a specific city or country, comparing a place from the ground and from space),
- technology (e.g. the effects of image processing, data transfers, tracking orbits and Shuttle/ISS positions), and
- mathematics (e.g. scale comparisons; area and density calculations).

## 2. Find and Explore Preliminary Images

Once, or as, you select a general topic, identify a few images appropriate for that topic. Then, use the Exploring Images Worksheet or the Exploring Images Online Worksheet and the How To guides to explore these images with your students.

What you and your students do now may be an integral part of your final projects... after some refinement and refocusing based on what your investigation covers.

## 3. Identify Research Question(s)

When you and your students reach the Getting Deeper phase of exploring the images, identify a research question(s) worth pursuing further.

Be aware that your research questions should be generalized versions of the questions that arise from the images. For example, questions such as, “Why do these rivers meander so much?” and “Why are these rivers so bright?” are great to ask about the Salado River, Argentina image (STS086.ESC.08162147). From these, an appropriate research question might be, “Why do rivers have the form and appearance they do?” In a class that is studying rivers or the water cycle, an investigation based on this question could fit right in.

## 4. Optional — Complete a Proposal Form

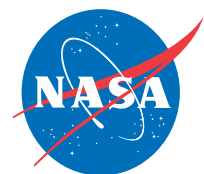
If you would like support, you can complete and submit the Investigation Proposal Form on the Web. A copy of the form is provided with this guide so you can make preparations off-line. You can even have students help prepare the answers off-line, though we ask that you—the educator—submit the Form online.

### ISS EarthKAM

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## STUDENT NOTEBOOKS

Throughout the investigation process, have your students create notebooks or otherwise keep a collection of all the work they do. Even work that ultimately doesn't fit into the investigation or its final project is work your students can learn from and you can evaluate.



## Conducting the Investigation

### 1. Search for Additional Images

The images you have already explored may or may not be the images that will be central to your investigation. Have your students look for other images appropriate to their research question(s). The investigation can revolve around one or many images.

### 2. Explore the Images

Decide which image(s) will be central to the investigation, and then explore the image(s). This time, with the research question(s) already selected, the explorations can be more focused.

### 3. Read and Conduct Other Research

Have your students spend some time doing book and Web research into the research question(s). Also, consider if you can connect experiments or other classroom activities into your investigations.

Whenever your students follow a line of research—reading, searching the Web, trying experiments, and so forth—make sure that they ultimately cycle back to examining the image(s).

- How is what they have researched connected to the image(s)?
- What can they see and understand in the image(s) that they couldn't see or understand before?
- What new questions do they have about the image(s)?

### 4. Pull the Materials Together

Have your students spend some time pulling all of their work together and then selecting out what they will include in their final piece. By doing this, they may discover that edits, such as changes in image annotations, need to be made to make their final project complete.

This also enables you to evaluate all your students' work. An inquiry-based investigation is not a straightforward process. Research that doesn't get included in the final project is still important learning—learning for which your students can receive credit.

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## DATASYSTEM TUTORIALS

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Tutorials on how to search the Datasystem are available in the Images section of the ISS EarthKAM Web site:

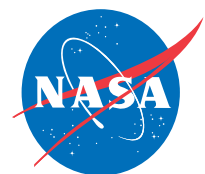
<http://www.earthkam.ucsd.edu/public/images/>

## CLASSROOM ACTIVITIES

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Investigations can be more than exploring the images and doing book research. For example, if you are investigating rivers, consider collecting data on a local river or creating a model of a river.

Also, you can make connections across subjects. For example, if you are doing a science-based river investigation, you can use scale bars to make measurements and do calculations that bring in mathematics. The sizes of rivers and water-side cities, can provide a lot of information and provoke interesting questions.



## Presenting the Investigation

### 1. Prepare a Final Project

Final projects can take many forms, such as reports, science fair displays, posters, Web sites, or multimedia presentations. Regardless of the format, however, final projects should include several features:

- a clearly stated topic and research question(s),
- the EarthKAM image(s) appropriately annotated,
- maps and/or text that place the image(s) in context,
- text that addresses what has been learned about the image(s) and the research questions(s). These should be intertwined; if what is being learned about the research question isn't directly connected with what is being learned from the image, then something is off-track. (Also, text about an image should always include the image ID number.), and
- references that give credit to the students involved and all the resources used.

These requirements are listed for students on the ISS EarthKAM Investigation Checklist located at the end of this document.

### 2. Optional — Submit a Final Project

If you are a member of the ISS EarthKAM Community, participating in taking photographs during a mission, you can fulfill your Sample of Student Work requirement by submitting an investigation. Select one, several, or all of your students' final projects that you would like to submit. Specifics on how to submit the projects are available on the ISS EarthKAM Web site.

### 3. Optional — Share ISS EarthKAM with Others

We encourage you and your students to share your ISS EarthKAM experience with others. This can be done by: setting up booths at a science fair, preparing a hallway display, posting pieces on the Web, or inviting families into an ISS EarthKAM showcase.

## SAMPLE OF STUDENT WORK

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ISS EarthKAM asks participants to share samples of their students' work with the program. Completed investigations are great items to share.



# Investigation Proposal Form

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1. **Title** — State the topic of your ISS EarthKAM image investigation (in 10 words or fewer).

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2. **Summary Explanation** — Describe the topic of your investigation more fully, including how it connects to your curriculum.

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3. **Images** — List and describe two ISS EarthKAM images appropriate to your topic.

First Image ID #: \_\_\_\_\_

Describe the image and how it relates to the topic of your investigation:

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List two questions inspired by the image that are relevant to your investigation:

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Second Image ID #: \_\_\_\_\_

Describe the image and how it relates to the topic of your investigation:

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List two questions inspired by the image that are relevant to your investigation:

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## Investigation Proposal Form (Page 2)

**4. Final Project** — Indicate what you will have your students produce as their final projects for this investigation.

- reports                       Web sites                       posters  
 science fair displays       multimedia presentation       other

**5. Resources and Schedule** — Provide some details on the time and resources you plan to dedicate to this investigation. We are aware that plans may change.

Your students will be exploring: (check all that apply)

- hardcopies of the images                       in the Datasystem on the Web

List the materials will you need for your investigation:

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Approximate number of class periods dedicated to your investigation:

- 3               4               5               6               7               8+

- Length of class periods: \_\_\_\_\_ minutes
- Approximate out of class time you want the students to dedicate to the investigation: \_\_\_\_\_ hours

• Select the month(s) when you plan to do your investigation: (check all that apply)

- September       November       January       March  
 October       December       February       April

• Type of Class(es)

- Science               Geography               Math  
 Social studies       Technology               Other

**6. Support** — If you want feedback on your proposal or other image-exploration support from the ISS EarthKAM Team, let us know how we can help.

- Please review my proposal and send me feedback  
 Please do what you can to support me with the following:

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# Investigation Checklist

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As part of your ISS EarthKAM investigation, you will explore one or more images in-depth, and you will try to answer a research question using the images and other sources of information. Then, you will create a final project. This sheet is a checklist of the things you should include in your final project:

- Topic of your investigation
  
- Research question(s) you are trying to answer
  
- Image(s) you explored
  - ID# of each image
  - Description of each image
  - Copy of each image with annotations
  
- Information on the area in and around the image
  - Map or maps with annotations
  - Description of the area, including the latitude and longitude
  
- Text about what you have learned from the image(s) and your other research
  
- List of the books and other resources you use in your investigation

