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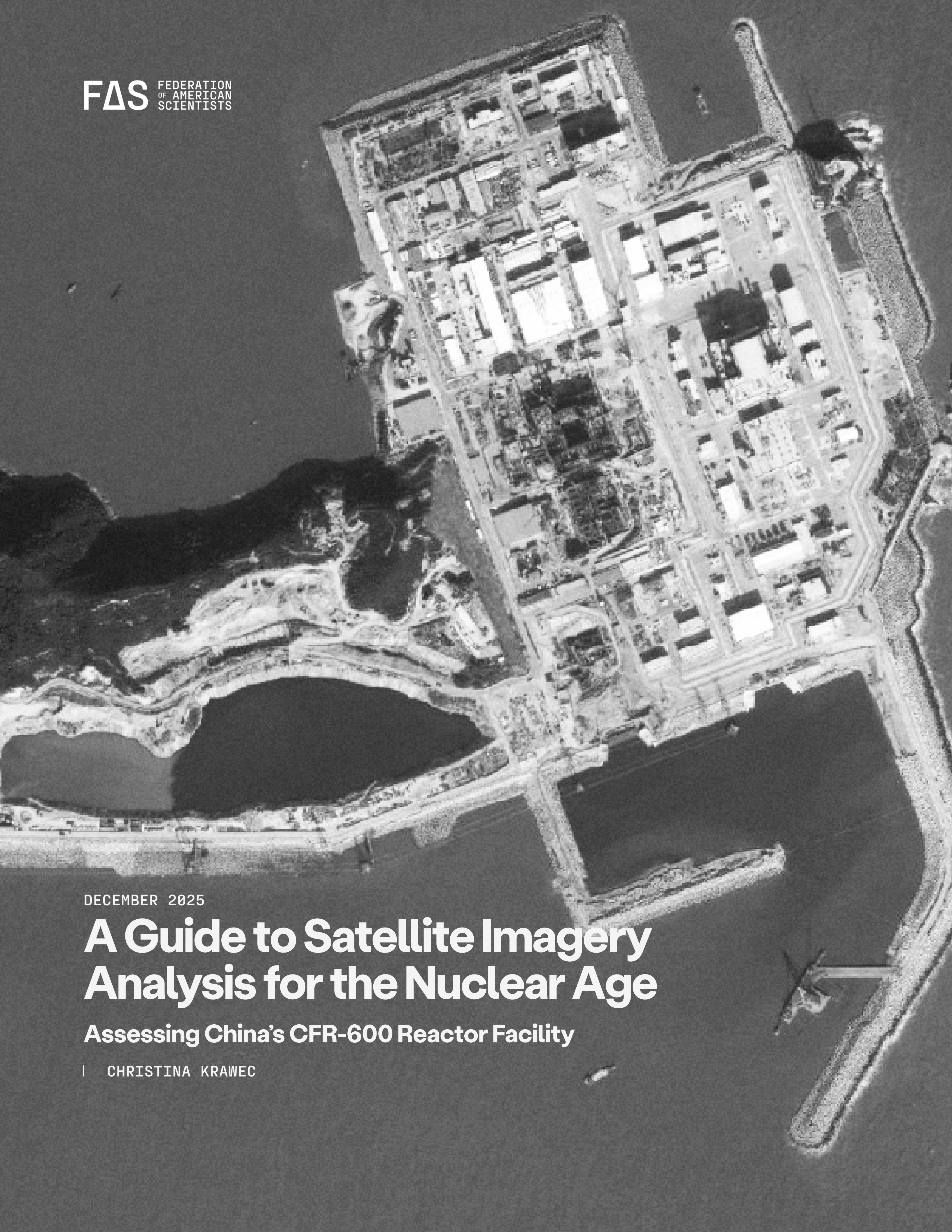

DECEMBER 2025

A Guide to Satellite Imagery Analysis for the Nuclear Age

Assessing China's CFR-600 Reactor Facility

CHRISTINA KRAWEC

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This report was adapted by FAS into a StoryMap – an interactive, multimedia narrative. Click here to view the StoryMap version of this report.

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Introduction

Satellite imagery has long served as a tool for observing on-the-ground activity worldwide, and offers especially valuable insights into the operation, development, and physical features related to nuclear technology. This report serves as a "start-up guide" for emerging analysts interested in assessing satellite imagery in the context of the nuclear field, outlining the steps necessary for developing comprehensive and effective analytical products.

What goes on in the mind of an analyst during satellite imagery analysis? Four broad steps included in this report – establishing context, collecting imagery, analyzing imagery, and drawing conclusions – serve as a simple outline for analysts interested in assessing satellite imagery with a particular focus on the nuclear field. This report uses China's CFR-600 reactor site as a case study, providing a roadmap to the analytical thought processes behind the analysis of satellite imagery.

Relevant Terminology

Electro-Optical (EO) Imagery – Satellite imagery that is collected via passive sensors that detect reflected solar radiation in the visible, near-infrared (VNIR), and often shortwave infrared (SWIR) portions of the electromagnetic spectrum. Imagery used in this report consists of processed electro-optical satellite images rendered in natural (true-color) composites for visual analysis.

There are several categories of EO imagery:

- **Panchromatic imagery** captures a single band of light in the electromagnetic spectrum and appears as a black-and-white image to the human eye.
- **Multispectral imagery** captures several discrete bands in the spectrum, and, depending on the specifications, can appear as a regular photograph (if limited to the red, green, and blue bands of visible light) or provide additional data (if incorporating non-visible spectral bands).
- **Hyperspectral imagery** captures data in tens to hundreds of narrow, contiguous spectral bands across a broad range of the electromagnetic spectrum.
- **Pan-sharpened imagery** is created by a process in which a high-resolution panchromatic image is combined with a lower-resolution multispectral image, resulting in a higher-resolution color image. This type of imagery is commonly used in public visualization platforms such as Google Earth, which display pan-sharpened composites from commercial satellites.

Nadir – The point on the ground that is directly beneath the satellite at the time imagery is collected. A nadir image is collected when the sensor is looking straight down from above, resulting in a 0-degree look angle. In contrast, an off-nadir image occurs when the sensor takes the image from an angle, resulting in a different on-the-ground appearance due to the increased angle of collection.

Open Source (OS) Information – Any information or raw data that can be legally and ethically accessed by the public, whether through research or purchase.

Open Source Intelligence (OSINT) – The analyzed product derived from OS information; OSINT products are the result of assessing publicly-available data and drawing conclusions or taking insights from it.[1],[2]

1 Note: In the public landscape, OSINT and OS information as terms have been used interchangeably to discuss both the data itself and the finished analytical product. These definitions outline the distinction.

2 The term "intelligence" also has a connotation that can be associated with classified source material – in other words, not open source information. Diplomatically, some organizations may use the term "open source information" to clarify that no classified sources have been used.

The Analytical Process for Satellite Imagery Analysis: The CFR-600 as a Case Study

This analytical workflow outlines the stages analysts take to collect, organize, and conduct satellite imagery analysis for nuclear sites. It is separated into four broad categories:

- Establish context;
- Identify & acquire imagery;
- Analyze imagery; and
- Draw conclusions.

Each satellite imagery analytical case is variable and has its own set of specifications. Therefore, these steps are intentionally generic and highly customizable, serving as a baseline for analysts embarking on satellite imagery analysis. Additionally, these steps are not necessarily laid out in chronological order, and their implementation could occur concurrently or interchangeably. While these steps are outlined specifically for the nuclear field, they can be applied to satellite imagery analytical projects in diverse other disciplines as well.

The following sections outline these four steps in detail using China's CFR-600 reactor site as an analytical example. This case study is of particular interest due to the fact that the CFR-600 units are fast breeder reactors (FBRs): they generate more fissile material (plutonium-239) than they consume. Therefore, the creation of additional weapons-usable material is of particular importance to the international community, and activity at the CFR-600 site provides insights into China's plutonium production capabilities and potential integration into the nuclear complex.

1. Establish Context

To conduct an accurate and well-informed satellite imagery assessment, analysts must have a solid general understanding of the area of interest. This step involves the collection, processing, and analysis of existing OS information outside the imagery itself. Establishing context is vital; without a thorough background in the site, analysts will be limited in the conclusions they can draw from the imagery. This step is highly variable and could involve a formal literature review or else more casual independent research. Relevant questions – including those related specifically to China's CFR-600 – are outlined below in Table 1.

TABLE 1. DEVELOPING CONTEXT AND DETERMINING EXISTING INFORMATION	
GENERAL	THE CFR-600 SITE
What geographical information is needed?	What are the coordinates of the CFR-600 site?
	What weather-related and seasonal conditions are expected in this area?
	What is the terrain in this area (arid, coastal, vegetated, etc.)?
What are the technical specifications of the facility, technology, or site of interest?	What are the components and technical specifications of the CFR-600?
	Are there other sodium-cooled fast breeder reactors that could serve as a baseline for providing technical specifications? If so, what information about these other models exist, and are they relevant?
	What are the energy needs of a CFR-600?
	How long, in general, would it take to build a CFR-600 reactor building and wider facility? (not necessary to determine, but something to keep in mind)

TABLE 1. DEVELOPING CONTEXT AND DETERMINING EXISTING INFORMATION	
GENERAL	THE CFR-600 SITE
What is the history of the site? What current events or news items may have affected on-the-ground activity at the site?	What has been the chronological progress of building the CFR-600 reactors?
	Which organizations were responsible for the development of the site? (What commercial publications exist?)
	When was fuel delivered for the CFR-600 reactors?
	Are there any corporate announcements or news articles in open sources regarding production milestones, delays, or accidents?
What research and analysis has already been published?	Has anyone already identified relevant features of the facility either on satellite imagery or otherwise?

Note that answering all of these questions prior to imagery analysis is not always required, but it is important to keep them in mind throughout the analytical process. The intention with this step is not to know everything possible about the site: it is about developing the relevant context and background expertise to complement and support a deeper understanding of the imagery.

Source Identification and Collection

General open sources include, but are not limited to, government publications, scientific and technical literature, corporate or commercial information, trade records, news reports, and social media. Imagery-related OS information includes not only the publicly available satellite imagery itself (from sources such as Google Earth Pro and Sentinel Hub), but the geospatial-related data that might provide geographical context for an analyst. This includes ground photos, video footage, drone/overhead imagery, blueprints, and maps. Any information that could give an analyst more information about on-the-ground activity is included in this category.

2. Identify and Acquire Imagery

In many cases, analysts may be working with an image or set of images they are specifically provided and tasked to analyze. In others, analysts may need to search for imagery on their own. In either case, understanding the extent of available imagery can provide either the starting point for the imagery analysis itself or supplement the existing imagery with additional relevant information.

Questions to Consider:

- What spatial resolution do I need to look at expected features of interest?
- What time period is relevant?
- (If looking at multiple images) What changes over time are relevant?
- What free imagery is available and accessible?
- Do I need to locally download the imagery myself or can I track changes using an existing platform?

Several open source platforms provide imagery at different resolutions for free. These include Sentinel Hub (powered by the European Space Agency's Sentinel-2 satellites), NASA's Earthdata platform (including Landsat imagery), and the Google Earth Engine. Additionally, some commercial providers such as Planet, Vantor (previously Maxar), and Airbus offer free trial programs or unpaid access to lower-resolution images.

In the case of the CFR-600 site, I accessed imagery from commercial providers Vantor and Planet. I sought imagery fitting the following specifications, given previously-established context and background of the site:

- One image taken in spring or summer of 2025 to track recent construction developments, operation, and features visible at the site.
- One image taken in the autumn or winter of 2022, which was when the second CFR-600 unit was under construction with the main reactor building exposed.
- Higher-resolution (0.5 meter) imagery to see as much detail as possible.
- Cloud-free imagery for a clear view of the site.
- Pan-sharpened imagery, as viewing a photo looking "normal" to the human eye was most helpful for feature identification, and I would not be conducting any advanced geospatial analysis.

Tipping and Cueing

This is a helpful technique primarily used to identify relevant imagery of interest. It involves looking at lower-resolution, often more readily and publicly available imagery for identifying potential indicators of interest, and then using that as a guide to order or search for less-frequently-available, higher-resolution imagery.

For example, an analyst could use free, lower-resolution Sentinel-2 imagery to detect large-scale construction activity at a facility of interest. Once a change is identified – the "tip" – the analyst can use this initial information to search commercial archives or task a higher-resolution provider (such as Vantor or Planet) to acquire new imagery, effectively "cueing" the site for more detailed analysis. This approach is a cost-saving measure that helps analysts avoid spending resources on multiple high-resolution images without knowing how much value they might provide.

3. Analyze Imagery

Once imagery has been provided or collected, and other supplementary images have been consulted for context or additional utility, the analyst is ready to begin the analysis itself. This step is where all the contextual information collected in the previous steps is applied to the imagery at hand.

Questions to Consider:

- What image resolution am I working with – and what could I reasonably expect to see at this resolution?
- What time of day is it? How will shadows affect the visual signatures?
- How off-nadir is the image? The angle of collection will also affect how different features appear. For example, the sides of buildings will be invisible in a nadir image, while the walls of the building will be visible in an off-nadir image.
- What time of year is it, and what temperatures might be expected? Snow, rain, ice, or other seasonal weather conditions can affect the appearance of a facility.
- Is there any cloud cover in the image? What are the clouds blocking, and how does this affect the overall understanding of what is occurring in the scene?

Using all of this information, the analyst can then begin to identify features of interest, change over time, relevant developments, or other visual signatures at the site.

Key Elements of an Annotated Image

Part of conducting imagery analysis may include the development of an annotated image to serve as a visual guide to the analysis. An annotated satellite image should always contain the following information:

- Date of collection;
- Image attribution; and
- A graphic with an arrow pointing North. (North does not necessarily have to point "up." The analyst may select an image orientation that appears the most natural for viewing; the arrow itself is sufficient for providing directional context.)

Additional helpful descriptive data (to be included either in the image itself or in a label) includes a specific title, coordinates, and possibly a legend for more complex analyses. Annotated images should use a clearly-visible font and text boxes that stand out from the image itself. Bright arrows and specific lines should be incorporated for pointing out features with precision. Each following annotated image follows these guidelines, which are vital for communicating clear analytical information.

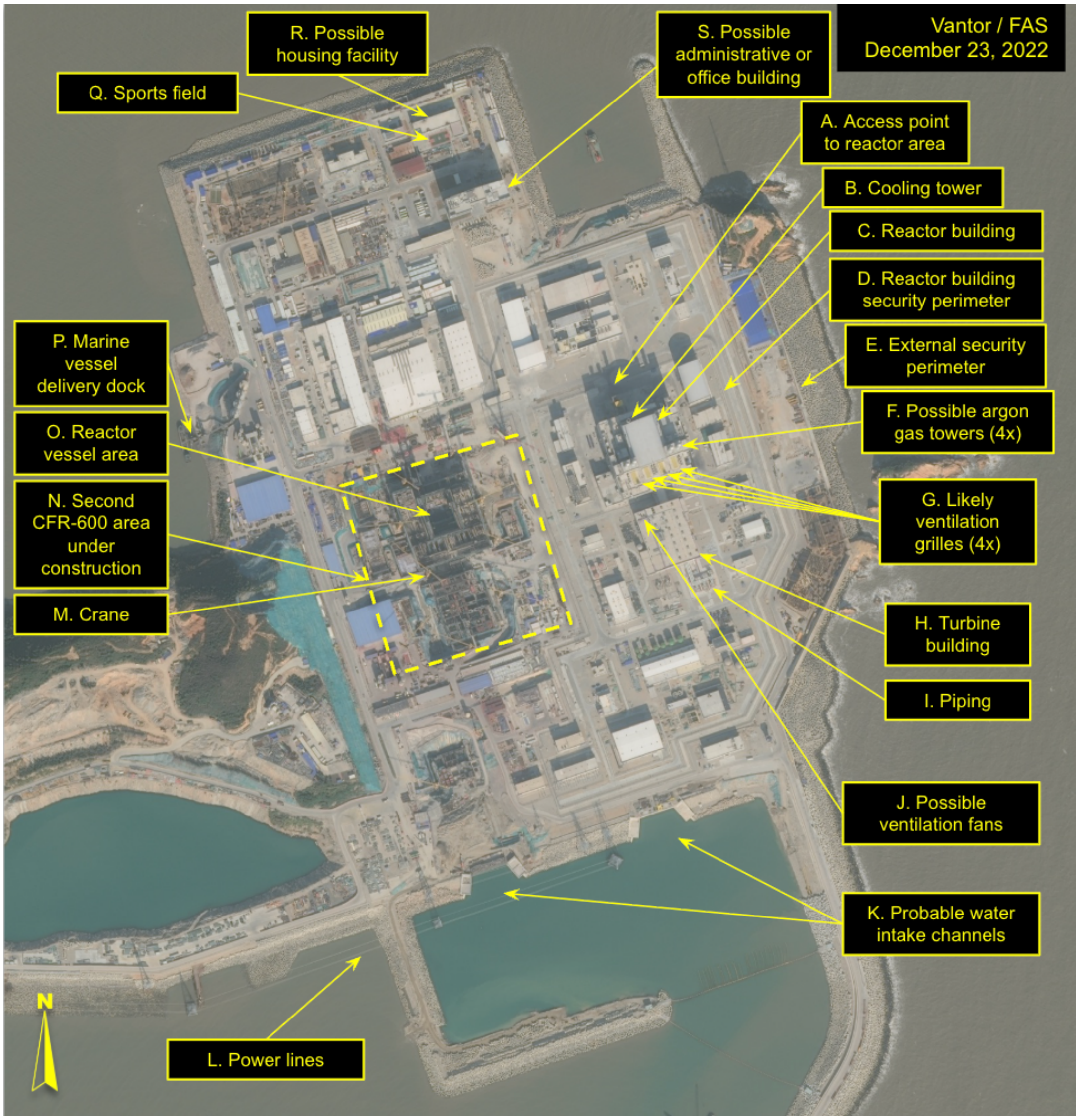

FIGURE 1. LAYOUT OF THE CFR-600 REACTOR SITE, DECEMBER 23, 2022. COORDINATES: 26° 48' 13" N, 120° 9' 18" E. IMAGE © VANTOR.

Visual Signatures at the CFR-600 Facility

Combining background expertise, context from open sources, freely available satellite imagery, and imagery specifically ordered for analysis, the CFR-600 site will be used to show how these recommended analytical steps are combined to identify features and gain information about a nuclear facility.

The CFR-600 is a sodium-cooled fast breeder reactor (FBR). "CFR-600" stands for "China Fast Reactor" with an output of 600 megawatts (MW). China began construction of the first CFR-600 unit in 2017, and this unit appears to be now operational. The second unit commenced construction in 2020, and is expected to come online in 2026.[3]

The CFR-600 uses sodium, not water, for cooling purposes, and, as a fast breeder reactor (FBR), creates more fissile material than it consumes. This combination of specifications will have certain visual signatures on satellite imagery, outlined in Fig. 1. Below (Fig. 2) is a guide to the expected internal components for the sodium-cooled FBR.

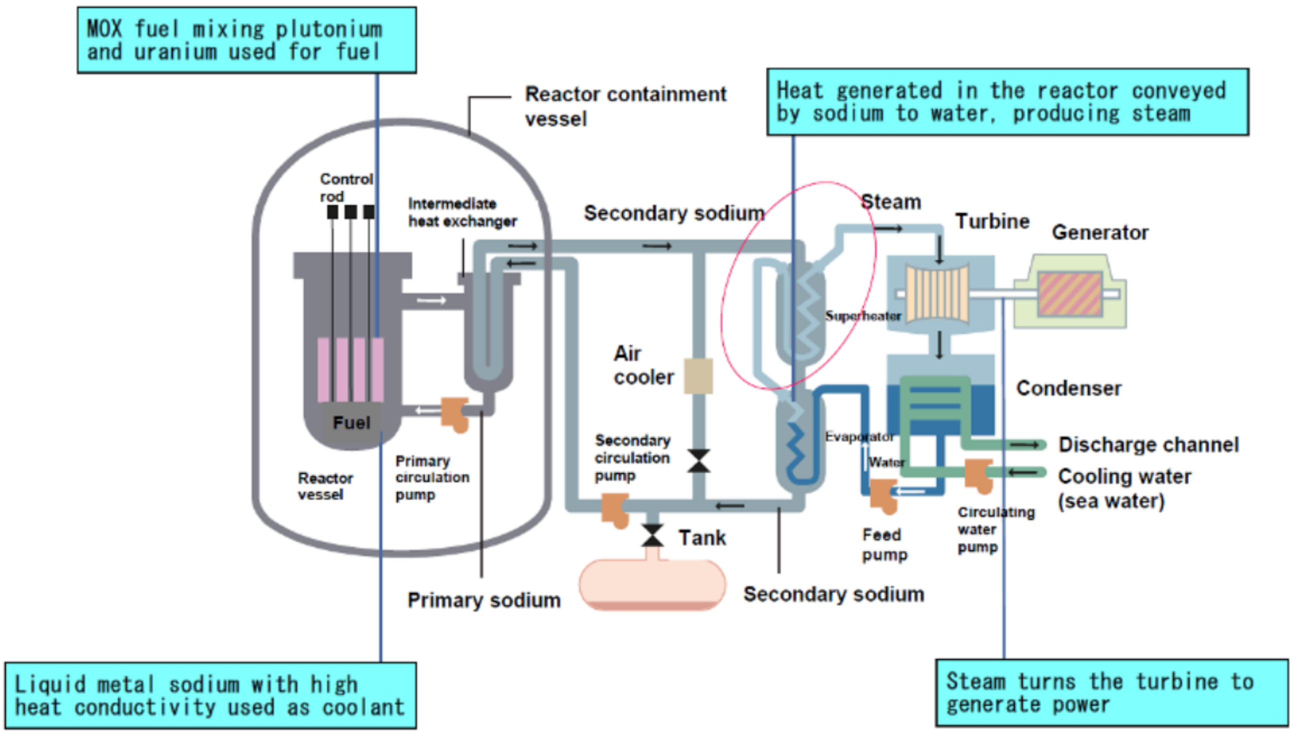

FIGURE 2. "THE MECHANISM OF AN FBR" - SASAKAWA PEACE FOUNDATION / T. IWAMOTO

Fast Breeder Reactor Area

Given typical sizes of fast reactors,[4] the reactor containment building could be 40-50 meters in length. For optimal containment, the rooftop is expected to be domed, and the building itself could be circular or rectangular. It would be made of reinforced concrete, appearing beige or gray on EO imagery. Expected features include an adjacent ventilation stack (appearing likely tall and cylindrical in nature), no windows, security perimeters (a wall or fencing), and few access points. A reactor will typically be fairly centrally located within a facility.

In Fig. 1, the reactor building is labeled as Annotation C. The domed rooftop is visible via the curve of the shadow to the North (Fig. 3). The cooling tower is also visible (Fig. 1, Annotation B). The two CFR-600s are located centrally within the facility.

3 Hui Zhang, "China Started Operation of Its First CFR-600 Breeder Reactor," IPFM Blog, December 15, 2023, International Panel on Fissile Materials, accessed November 13, 2025, https://fissilematerials.org/blog/2023/12/china_started_operation_o.html.

4 Yuki Kobayashi, "China's Fast Breeder Reactor Operating? Possibility of Accelerating Nuclear Arms Race," SPF China Observer (Sasakawa Peace Foundation), November 30, 2023, accessed November 13, 2025, https://www.spf.org/spf-china-observer/en/eisei/eisei-detail006.html.

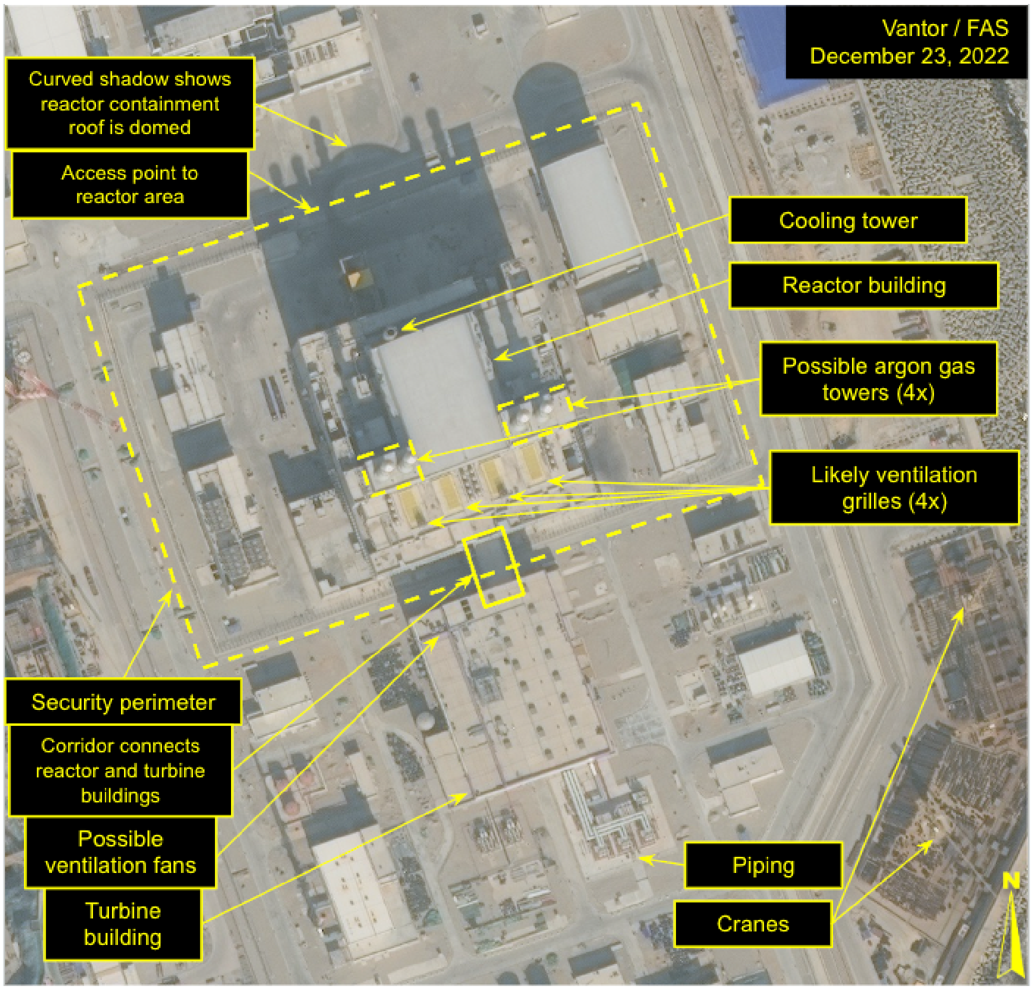

FIGURE 3. ZOOMED VIEW OF IMAGE USED IN FIGURE 1, HIGHLIGHTING REACTOR AREA FEATURES IN MORE DETAIL, DECEMBER 23, 2022. COORDINATES: 26° 48' 13" N, 120° 9' 18" E. IMAGE © VANTOR.

This ground photo of construction (Fig. 4) also shows the initial outline of the second CFR-600 reactor building, which can be cross-referenced with Fig. 1 to confirm the expected footprint of the reactor area.

A note on the cooling tower: for the CFR-600, it is unlikely that visible plumes of steam would be released from this stack. Sodium has a high boiling point, and operates at a low pressure.[5] While heat and inert gases are vented from the stack, they do not typically condense into visible vapor; therefore, plumes may not be visible in satellite imagery. At the CFR-600, the absence of a steam plume from the cooling tower does not imply that the reactor is inactive.

5 U.S. Nuclear Regulatory Commission, "Sodium-cooled Fast Reactor (SFR) Technology and Safety Overview (PDF)," February 18, 2015, accessed November 13, 2025, https://www.nrc.gov/docs/ML1504/ML15043A307.pdf.

FIGURE 4. GROUND PHOTO OF THE SECOND CFR-600 UNIT IN EARLY STAGES OF CONSTRUCTION

Sodium Handling Systems

The CFR-600[6] is cooled by a series of sodium transfer processes, as seen in Fig. 2. Visual signatures on satellite imagery could include storage or drainage tanks, but they may be covered or housed inside the building area. If visible, they could appear cylindrical and be located near the main reactor building. Draining or cooling pipes might be visible as well. Buildings with ventilation systems are expected. No open-water cooling ponds would be visible (as one might see at a water-cooled reactor).

In Fig. 1 (Annotation F), four tall, thin, evenly-spaced cylindrical stacks are visible, each with a metallic domed top. They are more clearly visible in Fig. 3. These could be argon handling towers, which are required for a sodium-cooled fast reactor system. Sodium reacts violently with water and air; therefore, argon is used as a cover gas to blanket surfaces of liquid sodium, preventing contact with oxygen or moisture.[7] The features of these towers are consistent with what might be expected for these types of units.

Another note on ventilation: Due to sodium's non-evaporative cooling properties, it would be unlikely for an analyst to see plume signatures emitting from any auxiliary ventilation infrastructure. Similarly to the reactor's main stack, a lack of plume activity from sodium-related ventilation systems does not indicate that the reactor is offline.

Fuel Handling and Hot Cell Area

The CFR-600 would almost certainly have a colocated fuel handling and hot cell area, given typical specifications for sodium-cooled fast reactors.[8] These systems would likely be housed in buildings either attached to or located close to the reactor containment building. They would be smaller than the main reactor containment dome.

6 World Nuclear Industry Status Report (WNISR), "Construction Start of Second Fast Reactor in China," WNISR Essential News, January 3, 2021, accessed November 13, 2025, https://www.worldnuclearreport.org/Construction-Start-of-Second-Fast-Reactor-in-China.html.

7 K. Satpathy, K. Velusamy, B. S. V. Patnaik, and P. Chellapandi, "Numerical Simulation of Liquid Fall Induced Gas Entrainment and Its Mitigation," International Journal of Heat and Mass Transfer 60 (May 2013): 392–405, https://doi.org/10.1016/j.ijheatmasstransfer.2013.01.006.

8 U.S. Nuclear Regulatory Commission, "Sodium-cooled Fast Reactor (SFR) Technology and Safety Overview (PDF)," February 18, 2015, accessed November 13, 2025, https://www.nrc.gov/docs/ML1504/ML15043A307.pdf.

Another possible attribute includes potential positioning closer to the vehicle access side of the reactor area (for ease of fuel transfer).

In Figures 1 and 3, there are several buildings attached to and located near the main reactor building. One or multiple of these is likely used for fuel handling.

Auxiliary Buildings

Other auxiliary buildings are also expected near the reactor building. These are variable in size, typically rectangular and flat-roofed, and could appear in various sizes, possibly 20-40 meters in length. These could be connected to the containment building via corridors, hallways, or underground tunnels.

Turbine Hall

Typically located close to the main reactor building, the turbine hall is used to generate electricity from steam produced by steam generators in the secondary loop (see Fig. 2). Turbine hall appearances vary by reactor design, but could be visible as a medium- to large-sized rectangular structure, depending on the facility's scale and layout.

In Fig. 1, Annotation H points to what is likely the infrastructure housing the turbine hall, since it is large in size and connected to the main reactor building via a corridor. It is possible that the steam generators are also housed in this same building, but these would require a ventilation system. Given the variable nature of vents (which can appear in differing shapes as fans, grills, or air ducts), it is not clear if the steam generators are also housed here or if they are located in the main reactor building.

Facility-Wide Cooling Systems

While liquid sodium is used for primary and intermediate cooling inside the reactor system, seawater is typically used for final-stage cooling processes. After steam is used to drive the turbine, generating electricity, it must be condensed back into water, and seawater can be used to provide the required heat sink for this process. Therefore, the CFR-600 facility is expected to have both seawater intake and discharge channels.

In Fig. 1, the intake channels may be located at Annotation K. Significant construction activity has occurred in this area over the course of the facility's development. The water discharge is visible in Fig. 5, with water visibly flowing back into the open water from the facility.

Administrative and Support Buildings

Additional support buildings may appear fairly standard and office-like, with multiple levels and windows. They will typically have connected roads and parking lots, lower security, and landscaping might be visible as well.

Other on-site infrastructure could include housing for on-call operators. The location of these buildings could be within the facility perimeter, but separated from the reactor building itself. Evidence of these could be recreational areas, such as sports fields.

In Fig. 1, there are several buildings throughout the area that could be used for administrative purposes. Fig. 5 shows imagery with identification of likely support buildings and infrastructure. The northern area of the site appears to be utilized for recreation or housing, as two sports fields are visible.

Security Features and other Visual Signatures

In general, an FBR like the CFR-600 could be located near a large body of water for cooling effluent intake and release. Analysts should expect to see security perimeters around the entirety of the facility. Gated security checkpoints or entrances will be visible along the road or roads leading to the facility.

In Fig. 5, the finished security perimeter is visible.

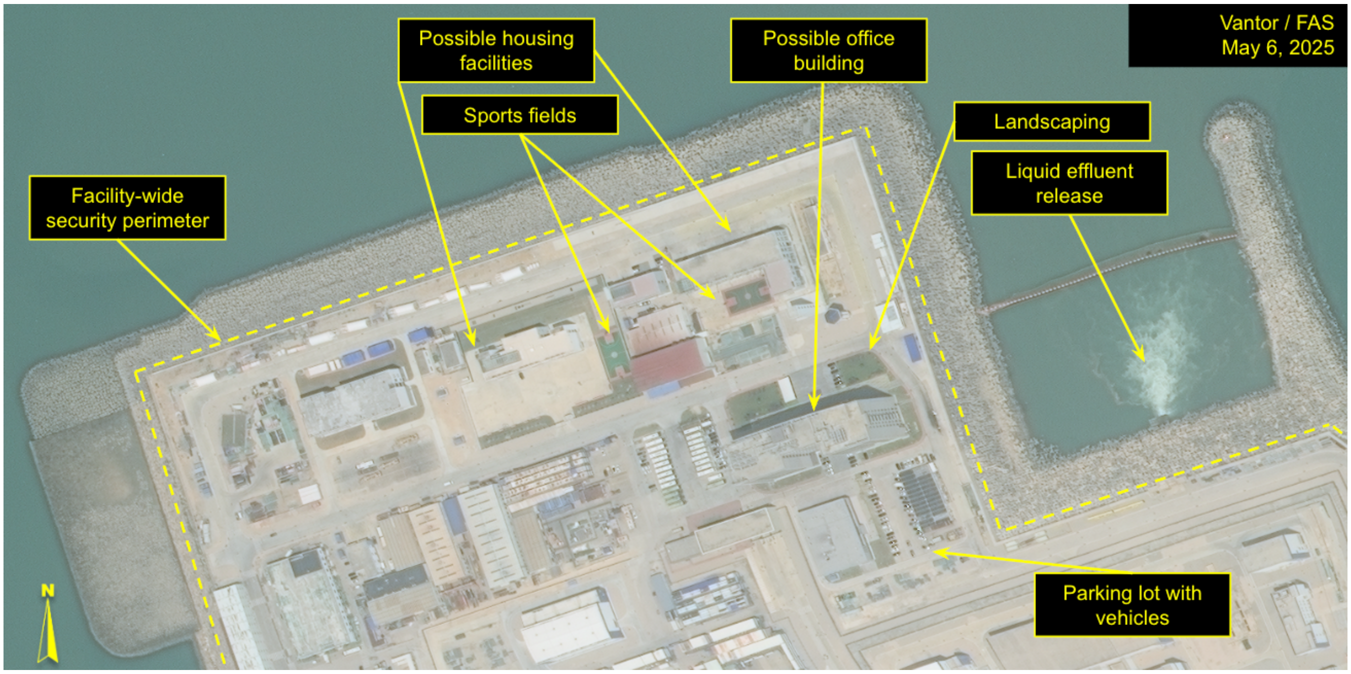

FIGURE 5. ADMINISTRATIVE AND SUPPORT AREA WITH VISIBLE WATER DISCHARGE AT THE CFR-600 SITE, MAY 6, 2025. COORDINATES: 26° 48' 13" N, 120° 9' 18" E. IMAGE © VANTOR.

Construction

If assessing older imagery, particularly as a facility is being constructed, analysts could expect to see trucks, heavy machinery, cranes, open buildings, raw material, earth or land movement, and other evidence of active construction and development. This is visible in Fig. 1 in particular, where the second CFR-600 is still under construction. In addition, at the CFR-600 building, the large, centrally-located feature with a domed roof is a key indicator that this is the reactor building. The adjacent smoke stack and additional features outlined above support this claim. In addition, previous imagery provides further evidence that this location is indeed the reactor housing unit. In Fig. 6, the reactor vessel outline itself, under construction, is visible, providing supplementary evidence that this building houses the reactor.

Additional Notes on Analysis

Levels of Certainty

The field of satellite imagery analysis is inherently uncertain. While some features may be readily identifiable, others may appear indistinct or ambiguous. This varies widely depending on all of the prior contextual information discussed and the experience level of the analyst.

Therefore, qualifying assessments with levels of certainty is key to a responsible, accurate, and transparent analysis. Terms such as "possible," "probable," and "likely" help communicate the degree of certainty associated with a given analytical interpretation. Examples of this terminology have been incorporated throughout the CFR-600 annotated imagery provided above.

Cross-Referencing

Even when analysts are provided specific imagery for a given analysis, it is highly recommended to cross-reference the imagery with other open source commercial images for comparison. See the "Construction" section for an example of this in practice: the newest imagery has been compared to older imagery to track ongoing progress.

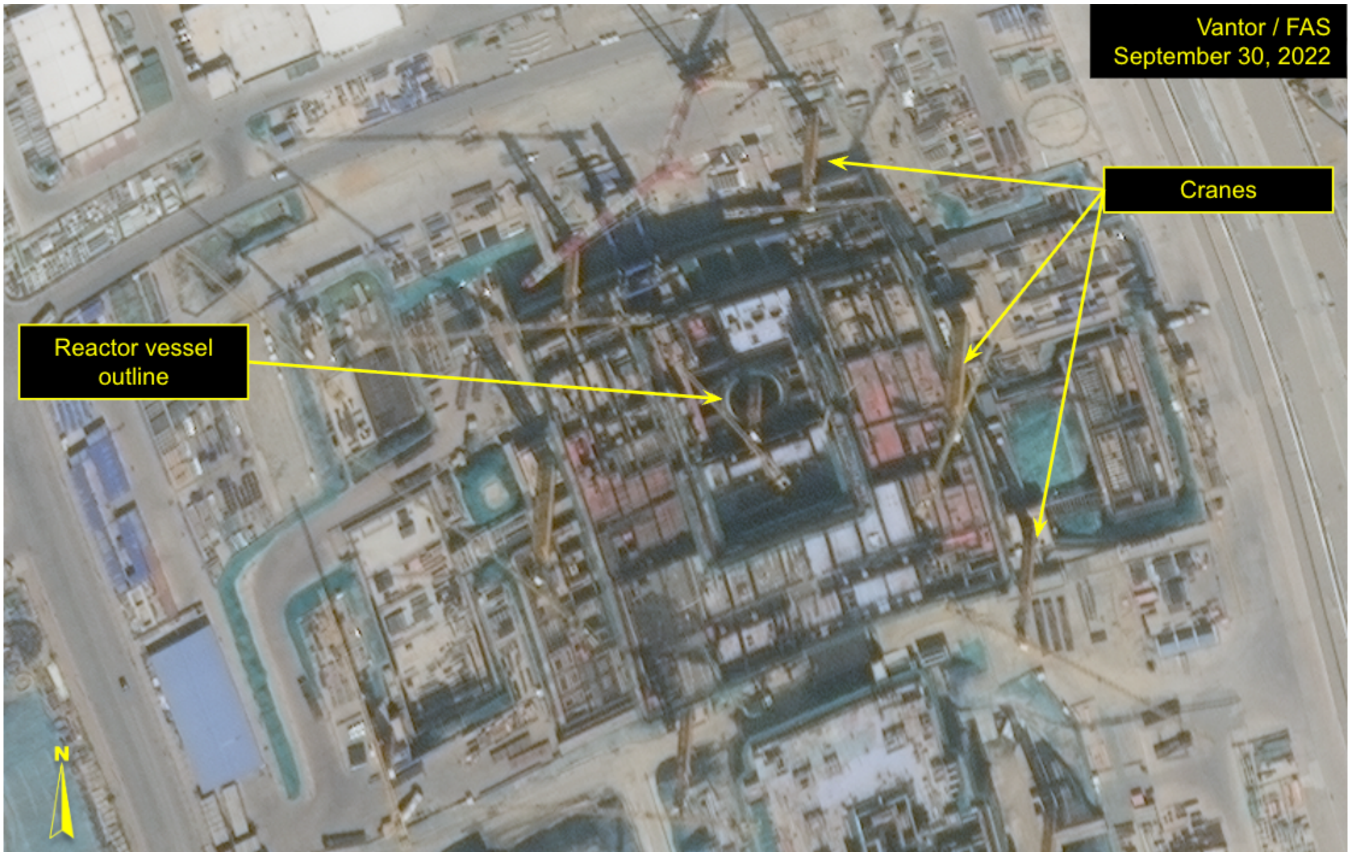

FIGURE 6. VIEW OF CFR-600 REACTOR BUILDING UNDER CONSTRUCTION, SEPTEMBER 30, 2022. COORDINATES: 26° 48' 13" N, 120° 9' 18" E. IMAGE © VANTOR.

4. Assess Findings

Drawing conclusions from imagery data – the "so what?" of the analysis – is a critical step of the imagery analytical process. These assessments must be based on observable on-the-ground features from the imagery cross-referenced with additional data and contextual OS information. These conclusions are dependent on the goals and questions pertaining to an analyst's project.

When assessing findings, analysts might ask:

- What appears to be the current status of the facility?
- Are there any deviations from expected development or operational patterns, particularly when assessing multiple images over time?
- Are there any unexpected large-scale interruptions noted on the imagery, such as major weather events, attacks, or accidents?
- Are there any specific features that appear unusual or deviate from expected patterns?
- How do the observed patterns inform us of the potential future activity at this site? What changes moving forward might be expected?

For example, the following serves as a brief assessment of the features identified at the CFR-600 site: Visual indicators suggest at least one reactor is currently operational. This is indicated by activity in the most recent image

(Fig. 5), in particular by the active flow of liquid effluent from the northern part of the site. The security perimeter appears neat and finished as well, suggesting that construction in this area is nearing completion. The features at the wider CFR-600 site (Fig. 1) are consistent with expected visual indicators for a sodium-cooled fast breeder reactor facility.

Analytical Challenges

For satellite imagery analysis conducted in the open source space, a single limitation[9] can disrupt the flow of effective and accurate analysis. Below are common restraints analysts face when acquiring or analyzing satellite imagery.

TABLE 2. COMMON BOTTLENECKS IN SATELLITE IMAGERY ANALYSIS AND POTENTIAL WORKAROUNDS

CHALLENGE	IMPACT ON ANALYSIS	POTENTIAL MITIGATION STRATEGY
Cloud Cover and Weather	On electro-optical imagery, cloud cover, snow, fog, smoke and adverse weather events can block ground activity.	Incorporate synthetic aperture radar (SAR) imagery to analysis
Imagery Costs	While several sources of free or low-cost imagery exist, commercial high-resolution images often require subscriptions and purchases, which could be prohibitively expensive and therefore can negatively impact analyst access to information.	Tipping and cueing
Spatial Resolution	The spatial resolution of an image – specifically, how much ground is covered in one pixel – will affect its appearance to the eye, clarity, and level of detail. Typically, lower-resolution images are more widely available to the public, limiting the amount of detail that may be observed and may be restrictive when analysts rely on small-scale visual signatures.	Use historical imagery as a guide; combine different imagery types
Time-Relevance of Imagery	Older imagery is generally more readily available than very new imagery. Therefore, analysts might rely on outdated visual evidence for their assessments, drawing conclusions that may no longer reflect current on-the-ground conditions.	Use Sentinel-2, which has a five-day revisit rate, for potential tipping
Satellite Failures	Imagery access is also affected by the limitations of commercial providers. Satellite health and operation can be unpredictable. For example, SatVu's thermal imaging satellite HotSat-1 failed six months after launch, impacting the commercial availability of high-resolution thermal imagery.	Try to use multiple providers when possible
Language Barriers and Local Context	Contextual and supporting OS information can rely on original-language documentation or signage. Language barriers can limit an analyst's ability to comprehensively include information from these sources.	Utilize machine translation services and seek out regional language specialists when possible
Limited Access to and Expertise Using Tools	Emerging imagery analysts may lack the expertise to harness geographic information system (GIS) software for analysis; many of these tools are costly as well.	Use free tools (such as QGIS) and develop independent skills by taking online courses

9 Jonathan Amos, "UK climate satellite fails in orbit just six months after launch," BBC News, December 15, 2023, accessed November 13, 2025, https://www.bbc.com/news/science-environment-67723524.

While imagery analysts face many challenges, the field changes frequently, with new tools, technology, and expertise constantly emerging. There are several strategies that can be used to work around these highlighted challenges, allowing independent analysts, even with few resources, to effectively and positively develop imagery analysis skills to impact the nuclear field.

Recommended Future Topics for Consideration

This report focuses specifically on satellite imagery analysis as a tool for analyzing nuclear-related sites. This report assumes that analysts have a basic understanding of the principles of OS analysis as a whole; future reports could discuss broader OS analysis topics such as safety and security, big data analysis, and ethics.

In addition, future discussions of additional satellite imagery technologies and analytical techniques would be useful. Synthetic Aperture Radar (SAR) imagery, for example, requires a different analytical perspective, as visual signatures will appear different to those on EO imagery. Standard analytical practices for SAR, thermal infrared, multispectral, and hyperspectral imagery in the context of nuclear technology would be additional topics of interest for future reports. This report also does not go into detail on the use of geographic information system (GIS) software for analysis; this is yet another area for future consideration.

Finally, this report also only focuses on one type of reactor and one step of the nuclear fuel cycle, with the CFR-600 example simply used as a case study. Several other case studies would provide emerging analysts with familiarity surrounding other phases of the nuclear fuel cycle, and would be highly valuable for providing broader perspectives on the application of satellite imagery analysis across the nuclear field.

Conclusion

Satellite imagery analysis is a powerful tool for gaining insights into nuclear-related infrastructure and technology. Mastering its use requires attention to detail, consistent practice, background knowledge, and contextual awareness. This report has introduced foundational techniques for imagery analysis while addressing key challenges and limitations. Using China's CFR-600 sodium-cooled fast breeder reactor as a case study, this report illustrates how to identify critical components, track change over time, and interpret visual indicators of activity. As satellite imagery becomes increasingly vital to open source nuclear monitoring and verification, these strategies can empower emerging analysts to produce meaningful insights and contribute positively to the wider nuclear and satellite imagery communities.

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