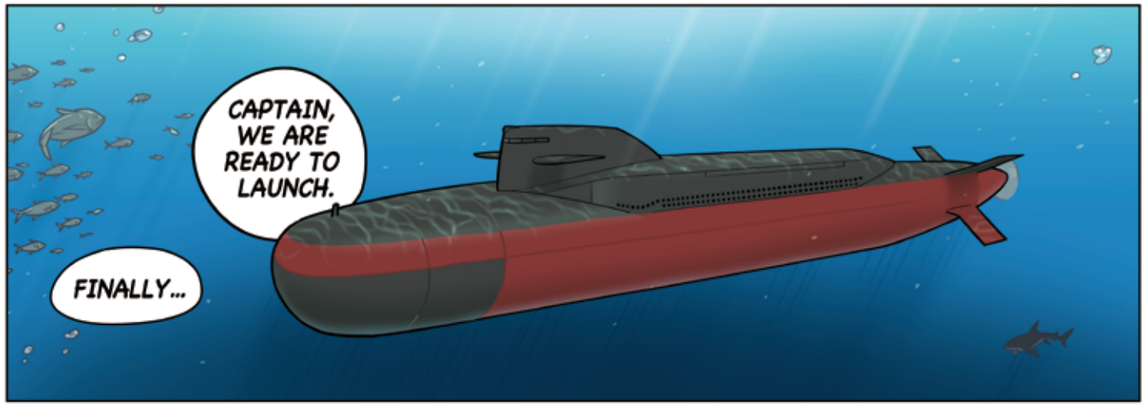
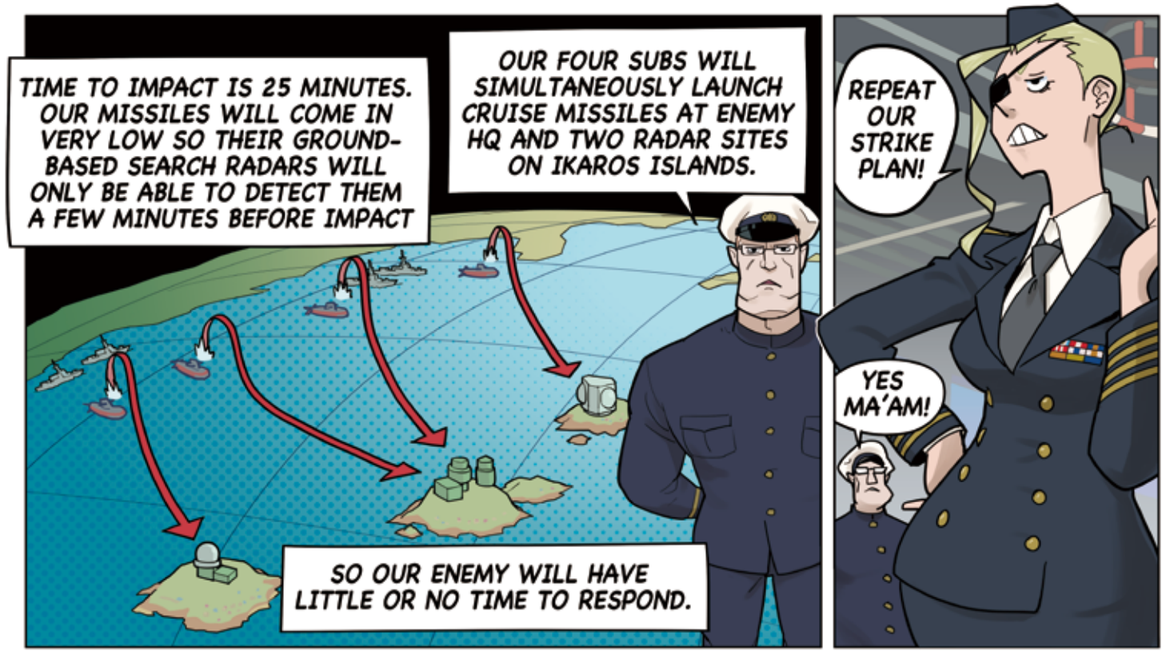
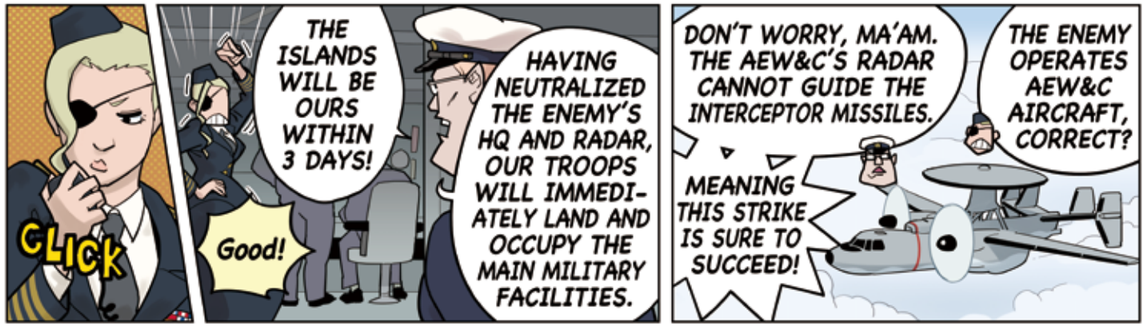






Episode 1:

Bolt from the Blue: Attacks on Remote Islands

Traditional warfare took place on land, air, and sea. Modern warfare can take place invisibly - on the network. This manga series and articles on "Network Centric Warfare" shows how the battlespace is transformed when aircraft, ships, radars, missiles, operations centers, and other equipment, are all connected.

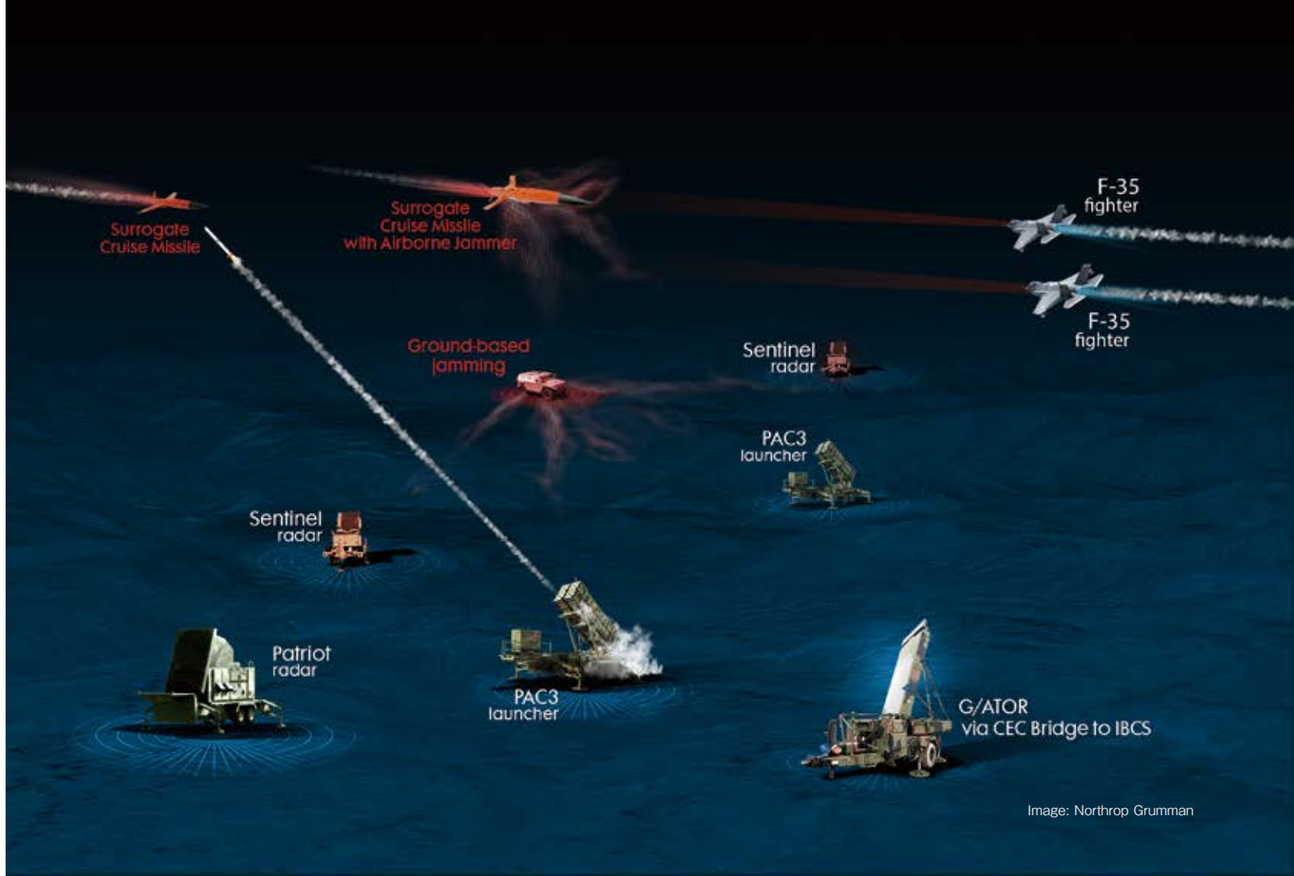


Image: Northrop Grumman

SUCCESSFUL INTERCEPTION BY PAC-3!

BOOM

SWOOSH

WHOOSH

WE WILL RECOVER THE IKAROS ISLANDS, WHICH WERE ORIGINALLY OURS!

ATTENTION! WITH THIS LAUNCH, WE ENTER A STATE OF WAR.

FIRE!

I REPEAT, PREPARE FOR SECOND ATTACK!

PREPARE FOR SECOND ATTACK.

WE HAVE SUCCESSFULLY INTERCEPTED ALL SIX HOSTILE MISSILES COMING FROM THE WEST.

ATTENTION!

SWOOOOOOOSHH

WE WILL SUCCEED IN OUR NEXT ATTEMPT!

UGH HH...

GRRRR

WE MUST RECONSIDER OUR ATTACK PLANS.

To be continued

SURPRISINGLY THE ENEMY'S FC RADAR COULD BARELY BE DETECTED...

THIS MAY BE THEIR NEW AIR DEFENSE SYSTEM.

ALL SIX OF OUR CRUISE MISSILES HAVE BEEN SHOT DOWN.

WHAT!?

HQ REPORTS.

BOOM

BOOM

SUCCESSFUL INTERCEPTION OF INCOMING MISSILES.

KA

High-quality data fusion defeats a surprise attack

Key Player for Interception: IBCS

It is common for aircraft and missiles to fly just above the ground or at sea level to avoid radar detection. From a defender's point of view, the incoming attack cannot be detected until the airborne threat appears over the horizon. There will not be enough time to prepare a response. Can we somehow solve that problem?

Modern Battle Command System by Network

In fact, in this episode, the defending force deployed IBCS (Integrated Battle Command System), a command and control system manufactured by Northrop Grumman. Using this system, they networked an anti-aircraft search radar and a surface-to-air missile system. The network used here is called an IFCN, or "Integrated Fire Control Network".

Originally, IBCS was initiated as a command and control system for the U.S. Army to realize the functions of an integrated air and missile defense. Therefore, the various anti-aircraft search radars used by the U.S. Army and surface-to-air missiles such as the Patriot can of course be connected to IBCS via the IFCN. But not only that, the U.S. military has also conducted demonstration tests to connect the F-35 and the Marine Corps' multifunction radar to IBCS. With an interface, it would be possible to connect to airborne early warning and control (AEW&C) aircraft and naval vessels. In addition, new radars and surface-to-air missiles that will emerge in the future will be assumed to connect to IBCS via the IFCN from the outset.

Without IBCS, individual surface-to-air missile units would learn of incoming enemy aircraft through communications from their command posts or their own search radars. They would then acquire data for engagement by capturing and tracking enemy aircraft with their own fire control radars, and then launch missiles to engage them. In other words, they can only engage within the range of their own means of detection. With IBCS, which networks search radars as well, IBCS provides both the "eyes" and the "brain" to command the entire situation from a bird's eye view.

Moreover, since IBCS is a system conceived for the Army, all of the equipment is mobile, making it possible to accompany ground troops engaged in battle while on the move. This makes it possible, for example, to rapidly deploy equipment to an island against which an enemy attack is believed to be imminent, and network anti-aircraft search radars and surface-to-air missiles on the spot.

It's Like "the eyes and ears of others connect to your own brain"

A target flying just above ground/sea level cannot be detected by ground-based radar until it appears over the horizon and comes into view. Therefore, attacking with cruise missiles flying at low altitude will not give the defender time to respond, and by the time the threat is detected, it is too late to return fire... This was the attacker's intention.

If the defender places its radar on top of a high mountain, it will have a somewhat wider detection range. Also, if there are AEW&C aircraft in the air, the detection range will further expand and the defender will be able to detect the incoming threat earlier (described as "bird's eye view" in the previous section). However, the challenge remains as to how to communicate information about the detected target. For example, whether communicated by voice communication or by image transmission of radar screens, interceptors cannot find targets with their own equipment until the threat comes within their own range.

This is where IBCS comes in. This system has the ability to fuse detection information from multiple networked radars into a single operational picture. By adding the radars of AEW&C aircraft or naval vessels at sea to the network, the surveillance range extends beyond the horizon. Sharing this information among all involved units improves situational awareness.

Rough Information Can Be Fused to Produce Enough Accuracy

The benefits of networking explained so far are easy to understand, but there's more: when multiple search radars in distant locations detect the same threat, it is possible to obtain highly accurate detection information at a level that can be used for targeting missiles. How is this possible?

To determine the position of a detected target with a single radar, information about direction and distance is required. With this information, a relative positional relationship can be determined. By adding the radar's position to this information, the absolute position of the target can also be determined.

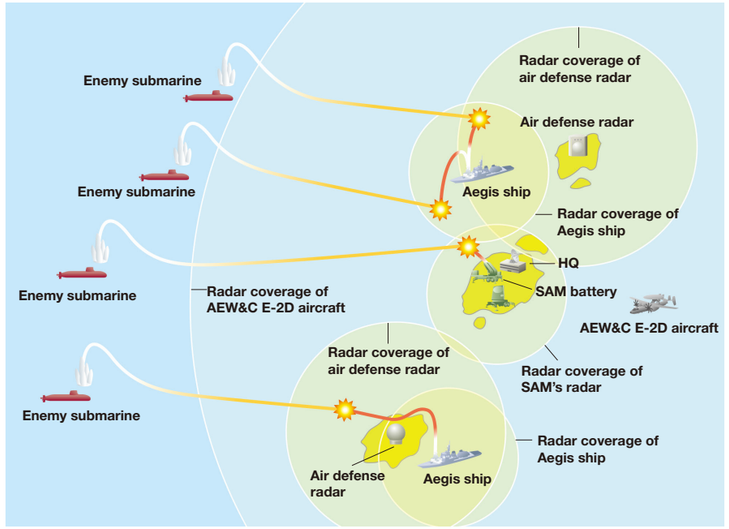
However, search radar and fire control radar require different levels of accuracy. Of course, fire control radar requires a higher level of accuracy. Therefore, in order to obtain high-precision targeting information, fire command radar usually uses high-frequency radio waves. However, this tends to shorten the detection distance.

This is where IBCS comes in. As mentioned, IBCS can network multiple search radars and fuse their data. When multiple search radars detect the same threat, the direction and distance of the detected target from each radar will be different. The cross-point of the radar information is the position of the detected target. This allows for improved detection accuracy even with search radars that have a lower resolution than fire control radars. In other words, IBCS not only fuses detection information from multiple radars, but also enables detection with a level of accuracy that exceeds the capability of each single search radar alone.

Feat of Shooting beyond Range of the FC Radar

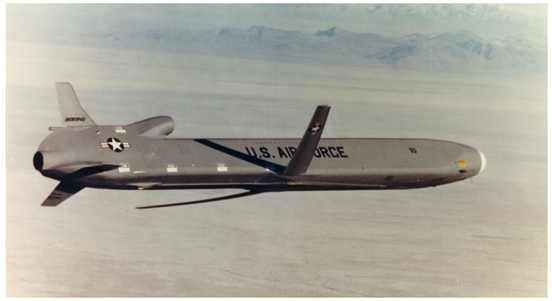
Next come SAMs (surface-to-air missiles and ship-to-ship missiles), which, due to the aforementioned circumstances, do not have very long-range fire control radar. However, if accurate detection information can be obtained from others, it may be possible to use this information to engage in battle outside the effective range of its fire control radar. Even when intercepting a target with its own fire control radar, if the SAM has more precise information of the flight path of the threat before it appears over the horizon, it can be expected to shoot it down more reliably. Moreover, if search radars and SAMs are networked via IBCS, the transmission of detection information would be quick and reliable.

At first glance, IBCS may appear to be a system that is only responsible for air defense of ground units. In reality, however, it is more than this. The U.S. is developing the Joint All Domain Command and Control (JADC2) concept, which seeks to centrally command and control all areas of operation (domains), and IBCS is one of the various systems that operate under this concept. In other words, IBCS does not operate in isolation, but is linked to other operational activities in the battle space.



Interception Mission in This Episode

The submarine-launched cruise missiles flew at very low altitude toward the assigned targets but were quickly detected by E-2D in flight. With data from E-2D provided through the network, as well as fusing data from ground-based radars and phased array radars of Aegis ships, IBCS created accurate fire control quality targeting information. The Aegis ships and ground-based SAM battery received this information and fired interceptor missiles. They were even successful in intercepting incoming cruise missiles beyond their own FC radar range.



Boeing's AGM-86B ALCM cruise missile flying at a low altitude. Flight altitude is several tens to several hundred meters. (Photo credit: U.S. Air Force)

Northrop Grumman's AEW&C aircraft E-2D "Advanced Hawkeye." The U.S. Navy and the Japan Air Self Defense Force (JASDF) operate the aircraft. Its airborne radar covers hundreds of kilometers around. (Photo credit: U.S. Navy)

JASDF's FPS-3 (modified) air defense radar at the Tobetsu radar site in Hokkaido Prefecture. By establishing a radar on a mountain top, the radar surveillance range can be expanded. (Photo credit: Toshiharu Suzusaki)

Patriot Advanced Capability 3 (PAC-3) surface-to-air missile being fired from its launcher. The missile is capable of intercepting not only cruise missiles but also UAVs and ballistic missiles. (Photo credit: U.S. Army)