

from satellite-based infrared sensors and ground-based radars. In order to avoid launching nuclear missiles in response to a false alarm, a great deal of redundancy is built into these warning systems. In other words, if one channel for the flow information breaks down, there are other channels available to transmit the same message. In addition, there is a standard procedure which the US military has dubbed 'the doctrine dual phenomenology.' It requires that any warning coming from one family of sensors — space-based heat detectors, for example — must be confirmed by information coming from another family of sensors — the radars. Also required is corroboration from human 'intelligence' such as diplomatic reports, espionage, and the like. The US Department of Defense claims that the redundancy of the system and the requirement for multiple, simultaneous warnings make accidental nuclear war very unlikely.

EUROPEAN THEATRE

US nuclear weapons which are based in Europe present a different set of problems. The short-range tactical nuclear weapons are integrated into the conventional force structure of NATO, and plans for their use are incorporated into the operational procedures for fighting a war in Europe. These tactical weapons, along with the intermediate-range nuclear forces (INF),* belong to the US but are based on the territory of European countries. The joint control of these forces by military personnel from different nations requires stringent control during peacetime. The weapons deployed in Europe are equipped with 'permissive action links' (PALs) which serve as electronic locks. The use of nuclear warheads requires a coded electronic message from the Supreme Headquarters of the Allied Powers in Europe (SHAPE). As long as these codes are withheld the use of nuclear weapons by unauthorized personnel or by terrorist groups is highly unlikely.

DANGER DURING CRISIS

Political and military leaders are aware that strategic nuclear weapons, if they must be used, are most effective in a coordinated attack, implemented according to carefully developed plans, especially if the attack is aimed against military targets.

Strategic analysts and others are concerned about the danger of accidental nuclear war, not during ordinary peacetime conditions, but during a time of crisis. Decision-makers will be under pressure to ease off on

*It now appears that these INF weapons will soon be removed from the European theatre since an agreement to dismantle these systems has been negotiated between the US and the USSR.

negative controls and enhance positive control so that the missiles can be used according to plans, before they and the leaders who command them can be destroyed.

Within the North American Aerospace Defence Command, there is a well-defined sequence of events leading from the point where infrared sensors on US satellites first detect the heat of the booster rockets on Soviet missiles, to the point where the US president gives the command to launch. What follows is a simplified summary of this sequence.

The initial detection by satellite-based sensors is relayed to a station on the ground where the raw data is processed and passed along to a NORAD command post. In response to the warning, officers on duty at the command post evaluate the possible threat in a 'missile display conference.' Even during peacetime these 'non-routine' conferences are called, on average, once every couple of days (153 such conferences were called in 1984), because the Soviet Union and China frequently test-fire their missiles and because there are a variety of natural phenomena such as meteor showers which can produce readings that can trigger a missile display.

If the duty officers become convinced that the warning is not a benign event, such as a test, but represents a genuine threat, they seek further information from other sensors. A second warning coming from the system of radars is taken as a corroboration of the initial detection. A conference of more senior military personnel, including the chairman of the US Joint Chiefs of Staff, is called to assess the threat. This is referred to as a 'threat assessment conference.' It is at this point that the strategic bombers take off as a precautionary step. If the senior personnel determine that the threat is real, they contact the president. In their report, they grade their assessment as having either low confidence or high confidence. This report leads to a third level of conference, the 'missile attack conference,' which involves the senior military personnel and the president. (No such conference has ever been called except during war games.) If the president then decides to launch a retaliatory strike, he gives orders to send the electronic code to the launch control officers waiting underground.

With the advent of ICBMs the entire sequence from first warning to launch has to take place within twenty minutes in order to avoid having the missiles destroyed in their silos. But there is the question whether decision-making under such a restricted time frame can, or will, be 'rational.'

During international crises, US nuclear forces have sometimes been thrown into a higher level of readiness in order to send a political message to the other side. The purpose is to signal resolve. For example, at the end of the 1973 Middle East War a crisis arose when the US became concerned about Soviet involvement in the area. US strategic forces were put on alert. The crisis was resolved when the USSR agreed to send only