An hourglass-shaped graphic with a globe inside. The top bulb is dark blue, and the bottom bulb is light blue. The globe is a darker shade of blue. The hourglass is centered on the page.

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*National Security Implications of Airborne Early Warning  
(AEW) Aircraft*

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**Abstract.** Airborne early warning (AEW) aircraft significantly improve the effectiveness of modern defensive and offensive air operations. Presently only a few countries manufacture such aircraft. The demand for AEW aircraft, is growing however, as their utility is recognized. AEW aircraft have been sought by China and India, each a party in regional rivalries. Congress is likely to review the U.S. national security interests and policies raised by these cases.

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# CRS Report for Congress

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## National Security Implications of Airborne Early Warning (AEW) Aircraft

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### Summary

Airborne early warning (AEW) aircraft significantly improve the effectiveness of modern defensive and offensive air operations. Presently only a few countries manufacture such aircraft. The demand for AEW aircraft, is growing however, as their utility is recognized. AEW aircraft have been sought by China and India, each a party in regional rivalries. Congress is likely to review the U.S. national security interests and policies raised by these cases.

### Background

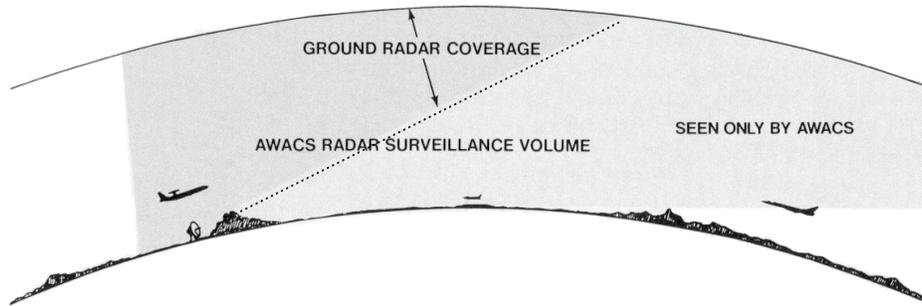
#### Introduction to Airborne Early Warning.

Airborne early warning (AEW) aircraft significantly improve the effectiveness of modern defensive and offensive air operations. AEW aircraft provide a larger and clearer view of the battlespace, and the ability to more coherently organize and employ large numbers of aircraft over great distances and against a large number of threats or targets.

Because radar is effective only to the extent of its direct line of sight, the Earth's curvature limits the ability of most surface-based radars to detect low flying aircraft beyond about 30 miles. Modern aircraft can travel this distance very quickly; potentially eluding detection until they are literally on top of their target. By elevating early warning radars, say to 30,000 feet, low flying enemy aircraft can be detected at ranges up to 250 miles, providing better ability to prepare defenses and eliminate devastating surprise attacks. (Figure 1 illustrates this concept.)

AEW systems are often combined with command, control and communications (C<sup>3</sup>) equipment – such as identification friend or foe (IFF), electronic and communications intelligence (ELINT and COMINT), advanced navigation and jam-resistant tactical data links. The resulting AWACS aircraft (Airborne Warning and Control System) can be used not just to provide warning to defenses, but also to effectively control large numbers of aircraft on both defensive and offensive missions, over a large area against a large

**Figure 1: Comparison of Ground-based and Airborne Early Warning Radar Coverage against Low Flying Aircraft**



number of threats or targets. In sum, AWACS aircraft may be considered “force multipliers.” They facilitate the coherent use of large numbers of aircraft, over great distances against numerous threats or targets, that would otherwise operate in small groups with relatively limited operational “vision.”

### Summary of Select AEW Systems.<sup>1</sup>

AEW aircraft are very sophisticated, and even technologically advanced countries like Britain have decided that purchasing such aircraft is more attractive than building them. Thus, in 2000 only a few countries produce AEW aircraft.

The United States makes the E-3 *Sentry* and E-2 *Hawkeye* aircraft. Both aircraft are distinguished by a large, slowly rotating disc-shaped surveillance radar attached to the aircraft’s fuselage. These pulse-doppler radars can perform numerous surveillance functions simultaneously, and track hundreds of objects at hundreds of miles. These aircraft also employ a variety of C<sup>3</sup> technologies in severe electronic warfare environments. Designed to operate from aircraft carriers, the E-2 aircraft is noticeably smaller than the Boeing 707 aircraft on which the E-3 is based.

The Russian A-50 *Mainstay* aircraft also employs a rotating pulse-doppler radar on a large aircraft (IL-76) and most closely resembles the E-3. The *Mainstay* uses IFF, electronic warfare (EW), and other C<sup>3</sup> equipment. Some contend that the A-50 is not as capable as the E-3,<sup>2</sup> yet even the baseline A-50 can simultaneously track 50 fighter-sized

<sup>1</sup> Only the most current and capable AEW aircraft are included here. This section does not address legacy aircraft, such as the Russian-built Tu-126 Moss. This aircraft’s AEW capabilities are rudimentary, and it has been phased out of most countries’ inventories. Nor does this section include maritime reconnaissance aircraft – such as the British Nimrod aircraft or Search Water radar – which have some modest early warning capabilities.

<sup>2</sup> Federation of American Scientists. *Beriev A-50 Mainstay* [<http://www.fas.org/nuke/guide/.htm>]

targets at about 140 miles.<sup>3</sup> Russia offers various A-50 variants for export to control air defense and counter-air fighters such as the SU-27 and MiG-29.

Israel and Sweden have recently fielded AEW aircraft based on the most sophisticated radar technology. Abandoning rotating pulse-doppler radars, the Israeli *Phalcon* and Swedish *Eyrie* are electronically steered radar arrays that provide full 360 degree surveillance coverage. The *Eyrie* radar sits in a rectangular box mounted on the *Argus* aircraft. The *Phalcon* radar has been tested on several aircraft, and conforms to the aircraft fuselage. These radars put less stress and drag on the aircraft than do roto-domes. This, in turn can result in longer time on station, longer lived aircraft, or the use of smaller, more versatile aircraft. The *Argus* transmits its data to ground based controllers, while the *Phalcon's* 10-13 member on-board crew controls fighter operations directly.

### **AEW Aircraft in Military Operations.**

The military value of AEW/AWACS aircraft has been proven in numerous conflicts. The success of Israel, for instance, against Syrian aircraft in the 1982 Lebanon War owed much to U.S.-built E-2 Hawkeye AEW aircraft in Israeli service. E-2s routinely detected incoming Syrian aircraft at long range and vectored Israel fighters to surprise them.<sup>4</sup> The E-2s also supported Israeli air attacks. In 1985, Israeli F-15s, accompanied by an E-2 flew 1,500 miles to bomb PLO headquarters in Tunisia. By contrast, the British lack of AEW aircraft is considered a major factor in the loss of two destroyers to cruise missiles launched by Argentine fighters during the 1982 Falklands war. Lacking long range surveillance, the British were forced to position the HMS Sheffield and HMS Coventry in postures that increased their vulnerability.<sup>5</sup>

Carrier-based E-2C aircraft directed F-14 fighters during the strike against Libya in 1986. E-2Cs and AEGIS cruisers, working together, provided air superiority over the fleet. Libyan aircraft probed U.S. defenses at least 153 times but never got into firing position before being locked into the sights of a U.S. aircraft or AEGIS platform missile.<sup>6</sup>

During the 1991 Gulf War (Operation Desert Shield and Operation Desert Storm), U.S. AEW aircraft contributed significantly to the coalition's overwhelming air campaign. E-3B aircraft provided 24-hour radar coverage throughout the war. AWACS gave early warning of Iraqi air activity and helped control engagement of Iraqi aircraft. It also supported strike packages. E-2C aircraft tailored tactical control, filtered intelligence, and improved the situational awareness for Navy strike groups and Coalition forces.<sup>7</sup>

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<sup>3</sup> Jane's Radar and Electronic Warfare 1997-1998. Jane's Information Group. London.

<sup>4</sup> Nordeen, Lon. *Fighters Over Israel*. Orion Books. New York, NY. 1990:163.

<sup>5</sup> Luttwak, Edward, and Stuart L. Koehl. *The Dictionary of Modern War*. Harper Collins. New York, NY. 1991: 10.

<sup>6</sup> U.S. Navy Fact File. *E-2C Hawkeye*. June 18, 1999, and F.A.S. Web Page. [<http://www.fas.org/man/dod-101/sys/ac/e-2.htm>]

<sup>7</sup> U.S. Department of Defense. *Conduct of the Persian Gulf War: Final Report to Congress*. April 1992: 235-236.

NATO operated 33 E-3 aircraft in the 1999 conflict in Kosovo (Operation Allied Force). AEW aircraft played a key role in a war that some analysts contend was won by air power alone, and in which there was no allied fratricide and only two aircraft lost to enemy defenses. AEW aircraft coordinated complicated maneuvers such as night time, multinational aerial refuelings of up to 80 aircraft. A NATO E-3 also enabled the downing of three MiG-29s only four minutes after they took off from an airfield in Serbia.<sup>8</sup>

## China and AEW Acquisition

In recent years China has sought to upgrade significantly its conventional military equipment. Its force modernization program has included purchases of advanced combat helicopters, combat fighter aircraft, submarines and a variety of missiles. Russia has been the principal source of most of these advanced military items. While China's upgrade efforts can be viewed as a logical effort to maintain and enhance the capability of its military force structure, it also presents a worrisome situation for Taiwan. China continues to regard Taiwan as a renegade province of the Chinese state and periodically has made threatening gestures toward it. The United States, for its part, has undertaken, through law and policy statements, a commitment to seek a peaceful resolution to the PRC-Taiwan dispute. Pending such an outcome, the United States has provided military equipment to Taiwan to enhance its ability to defend itself against military attack.<sup>9</sup>

China's indigenous fighter aircraft are technologically inferior to Taiwan's F-16s and Mirage 2000 fighters. To address this weakness, China has imported Su-27 fighters from Russia, which are of comparable quality to Western fighters. Yet currently, China only has 48 of these aircraft, compared to a Taiwanese force of 240 modern fighters controlled by four E-2 Hawkeye AEW aircraft. The integration of AEW aircraft into China's air force would reduce many of these apparent deficiencies.

On July 12, 2000, a longstanding effort by China to acquire modern AEW capabilities from Israel reached a climax when, in response to United States opposition, Israel suspended its proposal to sell its Phalcon AEW system to China.<sup>10</sup> Under the suspended contract the Chinese reportedly had the option to purchase between three and six aircraft after receiving the first plane.<sup>11</sup> Once it became clear that Israel would not be the source of its AEW aircraft, the Chinese turned to their principal weapons supplier, Russia for a possible alternative. During the late summer and fall of 2000, reports indicated that China was considering seeking a number of Russian-built A-50E "Mainstay" AEW aircraft. This

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<sup>8</sup> Janssen, Joris. No Time Off for NATO's AWACS in the Balkans. *Jane's Defense Weekly*. May 19, 1999.

<sup>9</sup> For a detailed examination of China's conventional weapons acquisitions see: CRS Report RL30700, October 10, 2000.

<sup>10</sup> In November 2001 it was reported that China and Israel had begun re negotiations on AEW aircraft. Barbara Opall-Rome "China to Renegotiate Failed Israeli Spy Plane Deal." *Defense News*. November 5-11, 2001. p. 7.

<sup>11</sup> For detailed background on the Israeli-Chinese AEW sale see: Israel's Sale of Airborne Early Warning Aircraft to China. CRS Report RS20583, July 13, 2000.

aircraft would be an upgraded version of the A-50 AEW system, and would include a more advanced radar system than the standard Russian model of the A-50 aircraft.<sup>12</sup>

Published reports note an option for China is to lease two Russian A-50 aircraft for an interim period so that China's air force could conduct AEW training. During this interim period, the Chinese would work with Russia to upgrade the radar and avionics to be part of the newly built A-50E aircraft. Over a three year period, efforts would be undertaken to reduce the A-50's current vulnerability to electronic countermeasures, and to enhance its ability to engage in secure communication, among other things. The new A-50E would be designed to track 300 airborne and sea targets at a range of 250 miles compared to the A-50's current range of 140 miles. The A-50E would also be designed to control up to 30 aircraft, such as the Su-27 and Su-30 fighter aircraft, while serving as a C<sup>3</sup> platform.<sup>13</sup>

On November 3-4, 2000, Russian Deputy Prime Minister Illya Klebanov discussed the sale of A-50 AEW aircraft with the Chinese during a state visit to Beijing. It was subsequently reported that an agreement to sell the aircraft to China was reached during this visit. Press reports indicate that at least four new A-50E AEW aircraft would be sold. On December 13, 2000, ITAR reported that initial delivery would begin in 2001.<sup>14</sup>

## India and AEW Acquisition

India has long been a major arms client of the former Soviet Union and Russia. India has also long regarded an AEW aircraft as a valuable asset for its military, having used the Tu-126 Moss in its 1971 war with Pakistan. When Israel suspended its sale of the Phalcon to China in July 2000, India reportedly discussed buying a system from Israel. Israel, appears reluctant to make the sale, due to concerns over U.S. objections. India is also concerned about U.S. objections. Russia wants to sell India an advanced version of its A-50 AEW system. India has assessed the current A-50 aircraft this year, and has expressed interest in obtaining it, if the plane can be upgraded. Indian software specialists are working closely with Russian and Israeli companies to develop new software that will improve the A-50's capabilities.<sup>15</sup> Russia has reportedly offered to lease two A-50 aircraft to India while a modernized A-50E is developed. Although Russian Prime Minister Vladimir Putin signed a number of agreements for weapons sales to India during his state visit to India in early October, no agreement was reached regarding a lease or sale of the A-50 at that time. It appears that India is continuing to consider its options, either to

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<sup>12</sup> *Defense News*, July 31, 2000, p. 16; *Defense Week*, September 18, 2000, pp. 1, 14; Agence France Presse, November 1, 2000; Reuters, November 3, 2000.

<sup>13</sup> *Defense News*, July 31, 2000, p. 16; *Defense Week*, September 18, 2000, pp. 1, 14; Agence France Presse, November 1, 2000; Reuters, November 3, 2000.

<sup>14</sup> Hong Kong Agence France Presse, November 9, 2000; Moscow Nezavisimoye Voyennoye Obozreniye (FBIS translation), November 10, 2000; Washington Post, November 19, 2000, p. 24. and *Aviation Week & Space Technology*, December 4, 2000: p. 31.

<sup>15</sup> Joshua Newton. "India Developing Advanced Software for Surveillance Aircraft." *Aerospace Daily*. August 23, 2001. p.5.

modify the A-50, or to explore a purchase of the Israeli Phalcon system if prospective U.S. objections to its sale can be overcome.<sup>16</sup>

India already enjoys a quantitative and qualitative advantage over Pakistan's air force. It has 21 more fighter squadrons than Pakistan, and a larger number of modern aircraft. Unlike Pakistan, India also has aerial refueling and electronic warfare aircraft. Improving its AEW capabilities will increase India's conventional aerial warfare capabilities. Perhaps more troubling, however, are the potential implications for aerial delivery of nuclear weapons. Many believe that India and Pakistan probably would rely on aircraft to conduct any nuclear strike – at least until their nuclear weapons are reduced in size or their missiles are made more powerful and reliable. Modern AEW aircraft could give India a greater probability of neutralizing Pakistan's air defense fighters.

## Considerations for Congress

In light of these two case examples, the U.S. government is likely to consider the adequacy of current regulations, policies, or multilateral agreements governing the transfer of AEW aircraft. Given the potential effect that acquisition of advanced AEW aircraft could have on China's military capabilities, the U.S. government may consider what courses of action are available to deter Russia from selling advanced AEW aircraft to China. If the sale does go through, Congress may confront a request to augment Taiwan's defensive capabilities. U.S. naval and air forces in East Asia may also be faced with a requirement to augment existing capabilities to counter potential threats posed by China's acquisition, and effective deployment of, AEW aircraft.

In view of the continuing tensions between India and Pakistan, the prospect of India acquiring advanced AEW aircraft could tip the conventional and nuclear military balance vis-a-vis Pakistan. This could lead to an escalation of conventional or nuclear military acquisitions by Pakistan in response because any future significant armed conflict between the two countries could prompt Pakistan to consider relying on nuclear weapons to avoid a conventional military defeat. Congress may consider it appropriate to monitor developments regarding the possible acquisition of AEW aircraft by India, and to support efforts by the U.S. government and others to dissuade suppliers from selling such aircraft. Some analysts argue that AEW aircraft confer more defensive capabilities than offensive capabilities, and are thus not dangerous weapons.<sup>17</sup> Yet, others disagree with this analysis. A 1987 book by an Indian Air Force officer, for instance, describes how the acquisition of AEW by Pakistan would give the Pakistanis a significant advantage in aerial combat and would prove destabilizing.<sup>18</sup> The growing availability of these aircraft and their potent affect on aerial combat capabilities could lead to the reevaluation of the prominence of the AEW aircraft proliferation issue in U.S. national security policy formulation.

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<sup>16</sup> *Defense News*, August 14, 2000, p.1, ff; *Defense Week*, September 18, 2000, pp.1, 15; *Flight International*, September 19, 2000, p.23; ITAR-TASS, September 21, 2000; United Press International, October 4, 2000; *Flight International*, October 10, 2000, p. 24.

<sup>17</sup> See CRS Archived Issue Brief IB81078 *Arms Sales to Saudi Arabia: AWACS and the F-15 Enhancement*, for a detailed discussion of this issue.

<sup>18</sup> Singh, Jasjit, *AWACS: The New Destabiliser*. Lancer Press. New Delhi. 1987.