From JAM SESSION to the PFIAB

Albert Wheelon and U.S. Intelligence

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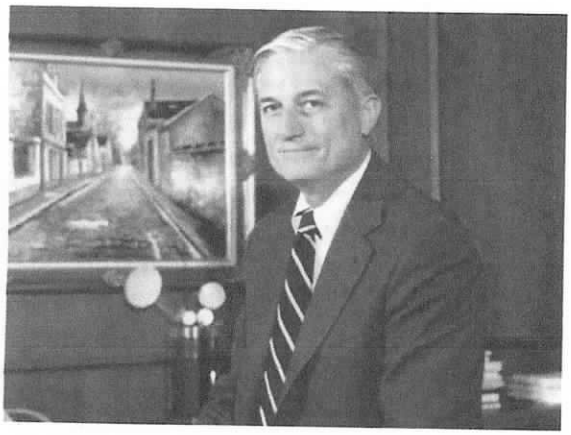
October 31, 2013



At the time of his death, on September 27, 2013, it had been a little more than forty-seven years since Albert D. "Bud" Wheelon had left his position as the Central Intelligence Agency's Deputy Director for Science and Technology to return to the private sector. He had spent a little over four years working for the CIA, but his involvement with the U.S. Intelligence Community both preceded as well as continued past that period. More importantly, his impact continues to this day and promises to last for years to come.

JAM SESSION AND EARSHOT

By the end of 1952, Wheelon, at the age of 23, was working in the fledgling U.S. guided missile program at Douglas Aircraft Company in Santa Monica – having received a bachelor's degree in engineering at Stanford, which he chose after concluding that West Point was "not interested in those with eyeglasses," and a doctorate in physics from M.I.T. The next year he joined the technical staff of Ramo-Woolridge (which would become Thompson-Ramo-Woodridge in 1958 and TRW in 1965). In 1960, he was appointed director of the company's Radio Physics Laboratory, which focused on guidance systems for long-range ballistic missiles and satellites.[1]

It was his work on missile systems that brought Wheelon to the attention of the CIA. In August 1957, a U-2 had photographed the Tyuratam ICBM and satellite launching facility. The next month, another U-2 mission photographed the Kapustin Yar Missile Test Range, including a large medium-range ballistic missile on its launch pad. Hoping to extract more information from U-2 images of Soviet missile sites and nuclear facilities, the CIA and Air Force recruited twenty-six experts on nuclear and missile technology – who might notice things in the photographs that others might not.[2]

Among the recruits were Wheelon and Army missile specialist Carl Duckett – who became members of the Special Engineering Analysis Group of the United States Intelligence Board's Guided Missile Intelligence Committee (GMIC). They, along with CIA photo-interpreters and other participants, became part of the effort named JAM SESSION. The analysis group began meeting on November 4, 1957, and "worked continuously through November 29" – and turned in a report that ran 141 legal-size pages and 14 figures. Not only did their work help advance understanding of the activities at both Tyuratam and Kapustin Yar, it also demonstrated the importance of employing signals and radar intelligence to produce all-source studies. Many years later, Wheelon recalled that "it was my introduction to intelligence and I found it fascinating."[3]

1. Central Intelligence Agency, *R.V. Jones Intelligence Award Ceremony Honoring Dr. Albert Wheelon, December 13, 1994*; Central Intelligence Agency, "Biographic Profile, Albert Dewell Wheelon," May 10, 1966; Interview with Albert Wheelon, Montecito, California, November 11-12, 1998.

2. Gregory W. Pedlow and Donald E. Welzenbach, *The Central Intelligence Agency and Overhead Reconnaissance: The U-2 and OXCART Programs, 1954-1974* (Washington, D.C.: Central Intelligence Agency, 1992), pp. 135, 138-139, 143; Wheelon interview.

3. Wheelon interview; Albert Wheelon, "Genesis of a Unique National Capability," December 19, 1984, address at CIA, pp. 7-8; [Deleted], *National Photographic Interpretation Center: The Years of Project HTAUTOMAT, 1956-1958, Volume II*, n.d., pp. 206-208, 217, 229, 276; [Deleted], *National Photographic Interpretation Center: The Years of Project HTAUTOMAT, 1956-1958, Volume III*, December 1974, p. 503.

Between 1960 and 1962, Wheelon undertook another intelligence assignment. This time the primary focus was not images but intercepted signals. The objective of the project, codenamed EARSHOT, was to decipher the meaning of telemetry transmitted by Soviet missiles during their test flights and the Soviet spacecraft that were being orbited at regular intervals. The Army and Air Force had been intercepting the signals but needed help in extracting intelligence from what their antennas had collected. The EARSHOT group was able to identify the different telemetry channels, calibrate them and draw some conclusions about the missiles.[4]

SCIENTIFIC INTELLIGENCE

His work on JAM SESSION and EARSHOT brought Wheelon to the attention of Herbert Scoville, director of the CIA's Office of Scientific Intelligence (OSI), and Robert Amory, the Deputy Director for Intelligence. When Scoville became the head of the newly created Deputy Directorate for Research in April 1962, which was intended to be a home for the agency's scientific and technical efforts, he recruited Wheelon to replace him as the head of OSI. Encouraged by James Killian, then chairman of the President's Foreign Intelligence Advisory Board, and other key officials to accept, Wheelon packed up and headed for Washington – where he assumed command of OSI in June.[5]

At OSI, Wheelon, who would look back and describe himself as "pretty brash," was not inhibited by the fact that he was only 33 years old. OSI staffers had to adjust to their new, "very demanding," boss. Some, Wheelon felt, had become accustomed to being administrators rather than making technical judgments and he sought to instill more confidence so they would be on more equal grounds when meeting with technical consultants. He was also averse to what he considered to be time wasting projects. When he discovered that Sayre Stevens, who would go on to become a Deputy Director for Intelligence, had been assigned to study Soviet windmills, he reassigned him to study Soviet air defense. In addition, with his wife and children still in California, he would stay in the office late into the evening and "began to press people hard." One division chief soon left for Colorado and a job at the North American Aerospace Defense Command (NORAD).[6]

As head of OSI, Wheelon was responsible for an office whose mission included producing analysis of foreign nuclear weapons, missiles, and air-defense programs. But the most critical analytical issue facing Wheelon during the year he would head OSI involved Soviet missiles in Cuba. The agency's Office of National Estimates (ONE) noted that the Soviets had never placed missiles on the territory of any of their satellites and believed they would not do so in Cuba. It was a position that McCone and Wheelon disputed. He had reached that conclusion in September after reading reports from human assets in Cuba as well as refugee debriefings – including one that described "very long trucks and trailers" which had to "make a turn in the central square" when passing through a small town. It was also reported that an asset saw a mailbox removed by an acetylene torch to allow the convoy to pass. Such details helped convince him of the report's significance. Wheelon, who wore a second hat as head of the interagency Guided Missile and Astronautics Intelligence Committee (GMAIC), formerly GMIC, presented his views to Sherman Kent, the national estimates chief. Kent told Wheelon that he had a lot of respect for him, but that while he appreciated his viewpoint, the conclusion of the upcoming national estimate would be different.[7]

In the aftermath of the key October 15 U-2 mission that proved McCone and Wheelon correct, Wheelon's role was to provide an evaluation of the offensive missile threat. Based on U-2 images, as well as information provided by Soviet military intelligence officer Oleg Penkovskiy, his memo reported on the presence of medium-range ballistic missiles at a variety of sites, specified the number of missiles and launchers visible at some sites, discussed possible future deployments and uncertainties, and reported on how soon the missiles might reach operational status.[8]

4. Wheelon interview; Wheelon, "Genesis of a Unique National Capability," pp. 8-9; telephone conversation with Albert Wheelon, January 28, 2000.

5. Wheelon interview; Wheelon, "Genesis of a Unique National Capability," pp. 8-9; telephone conversation with Albert Wheelon, January 28, 2000; Karl Weber, *The Office of Scientific Intelligence, 1949-1968, Volume I* (Washington, D.C.: Central Intelligence Agency, June 1972), p. 59.

6. Weber, *The Office of Scientific Intelligence, 1949-1968, Volume I*, p. 59; Wheelon, interview; telephone conversation with Albert Wheelon, September 16, 1999, Wheelon telephone interview, January 28, 2000; [Deleted], "Charting a Technical Revolution: An Interview with Former DDS&T Albert Wheelon," *Studies in Intelligence*, 45, 2 (2001), pp. 31-44.

7. David M. Barrett and Max Holland, *Blind over Cuba: The Photo Gap and the Missile Crisis* (College Station, Texas: Texas A&M University Press, 2012), pp. 10-11.

8. Albert D. Wheelon, Chairman, Guided Missile and Astronautics Intelligence Committee, Memorandum for: Chairman, United States Intelligence Board, Subject: Evaluation of Offensive

After the crisis was over, there were at least some who objected to Wheelon's refusal to sign on to the CIA position. Years later, he recalled that a representative of the Inspector General's staff visited to ask "How come you broke ranks with the DDI and the Office of National Estimates?" Wheelon's response was "You ought to be glad that somebody around here is yelling fire when there is a fire going on. You have got a nerve coming into my office and trying to brace me with an organizational loyalty issue. Where do you get off?"[9]

About a decade after Wheelon completed what would be a one-year stay at OSI, an official history of the office observed that "his effect on OSI in that short time was rather surprising." The accomplishments noted included establishing training programs, digging deeply into the adequacy of the source material available to his office, and spending "countless hours discussing, and all but inventing, new ways of increasing the flow of data." The history's author also noted Wheelon's "persistent demand for scientific integrity in analytical approach," which "certainly had lasting effects on the quality of OSI finished intelligence."[10]

Wheelon was appreciated not only in retrospect. In late February 1963, deputy director Marshall Carter sent a two-paragraph memo to Director of Central Intelligence (DCI) John McCone, noting that "I have been singularly impressed over the past months by the calm, unruffled, quietly analytical, and remarkably astute manner in which Bud Wheelon approaches all problems ... He is one of our finest assets." Carter urged the DCI to "bring him into the family circle at every opportunity and to utilize him as a source of basic judgment ... in areas which trouble you."[11]

DS&T

Despite his willingness to assume command of OSI and his knowledge of the deputy director's favorable view of his work, Wheelon was more than a little surprised when, in the wake of Herbert Scoville's resignation in the spring of 1963 (ultimately effective in June), he was offered the job of Deputy Director for Research. At the time, Wheelon was actually considering leaving the agency, having come to Washington expecting to work for Scoville or Robert Amory and not Ray Cline, who had replaced Amory as head of the intelligence directorate. Cline was someone "I did not much care for," Wheelon later recalled. But he was also reluctant to take Scoville's job – aware of the problems Scoville had with the National Reconnaissance Office (NRO) as well as with McCone. In the later case, Scoville felt he could not count on McCone either in his battles with the NRO or within the agency – as illustrated by McCone's failure to force Ray Cline to agree to transfer OSI from his directorate to Scoville's and Richard Helms to cede control of the Technical Services Division. Wheelon told McCone "We should not just screw another light bulb into a shorted-out socket."[12]

He did offer to speak to Scoville in depth about his reasons for leaving and was able to report back on Scoville's disappointment about his dealings with both the Pentagon and other CIA directorates – without stressing McCone's role. Wheelon was asked what he thought should be done and he answered both orally and in a paper of July 17. In that paper, Wheelon explored two options. The first, very briefly discussed, involved the dissolution of the research directorate, creation of a small R&D review staff, and transfer of the research directorate components to other agency directorates.[13]

The second option, treated at much greater length, was for a revitalized research directorate. It would have the authority to review all R&D items in the CIA budget, carry out all reconnaissance development and operations assigned to the CIA by the NRO, be designated by the DCI to review the NRO budget and program, and operate a Missile and Space Technical Intelligence Center (MISTIC). A section titled "Supplementary Comments on OSI," recommended transfer of the office to the research directorate, so that "OSI would be set in a scientific and technical environment."[14]

When the dust settled, there was a meeting in the CIA auditorium on August 6, 1963. Marshall Carter

Missile Threat in Cuba, October 17, 1962. Top Secret [Deleted] PSLAM [Deleted] IRONBARK, in Mary S. McAuliffe, *CIA Documents on the Cuban Missile Crisis, 1962* (Washington, D.C.: Central Intelligence Agency, October 1992), pp. 175-180.

9. [Deleted], "Charting a Technical Revolution."

10. Weber, *The Office of Scientific Intelligence, 1949-1968, Volume I*, pp. 60-61.

11. MSC [Marshall S. Carter], Memorandum for the Director, February 22, 1963.

12. Donald Welzenbach, "Science and Technology: Origins of a Directorate," *Studies in Intelligence*, 30, 2 (Summer 1986), pp. 13-26; Wheelon, "Genesis of a Unique National Capability," p. 12; Wheelon interview; Interview with Albert Wheelon, Montecito, California, June 14, 1999.

13. Albert D. Wheelon, Assistant Director, Scientific Intelligence, Memorandum for: Director of Central Intelligence, Subject: Deputy Directorate of Research, July 17, 1963. CIA Records Search Tool (CREST).

14. Ibid.

proceeded to announce the creation of the Deputy Directorate of Science and Technology (which became the Directorate of Science and Technology in 1965), explain the reasoning behind the decision, and identify the offices that would make up the new organization. He also announced that Wheelon would head the new directorate, and then turned the meeting over to the new deputy director for science and technology.[15]

Wheelon's new directorate included the three components that had reported to Scoville – the Office of Electronic Intelligence (OEL), the Office of Research and Development (ORD), and the Office of Special Activities (OSA). OEL, during Wheelon's tenure, helped fund a Norwegian ELINT station at Kirkenes and a subsidiary outpost to intercept Soviet communications and missile telemetry. OEL also subsidized a Norwegian ship equipped with antennas to gather data on Soviet naval operations. In addition, the office also operated a number of aerial projects against both East German and Chinese targets. But OEL's most important assets were established in 1965 and 1966 – two CIA-operated ground stations in Iran. TACKSMAN I at Beshahr, and TACKSMAN II at Meshed, 650 miles southwest of Tyuratam, were established to enhance the CIA's ability to monitor anti-missile testing at Sary Shagan and missile testing from Tyuratam. Equipment at the sites not only allowed interception of telemetry from missile tests but of test range communications.[16]

ORD's work involved more than working on cutting edge technology. During Wheelon's time it would operate two over-the-horizon radars. One, in Pakistan, codenamed EARTHLING, detected sixty-five missile launches from Tyuratam, before Pakistan closed it down in September 1965. Monitoring Chinese missile launches was the mission of another OTH radar, CHECKROTE on Taiwan, that began operations in August 1966. Its site had been the home of a graveyard, and Wheelon exerted considerable effort to get it moved.[17]

The Office of Special Activities, in 1963, was responsible for the U-2 and A-12 (OXCART) aerial reconnaissance projects. Its chief, Air Force General Jack Ledford, would recall that Wheelon had "three times the energy level" of Scoville and could "analyze a problem, take it apart, and put it together with a solution better than any man I've ever seen." One problem that would occupy both Ledford and Wheelon, that would be solved successfully, was turning OXCART from a developmental program into an operational one.[18]

Those three organizations, along with another three made up Wheelon's organization. In addition to OSI and the Office of Computer Services, a third component was the realization of the MISTIC concept Wheelon had outlined in his July 17 paper to McCone. It did have a new name – the Foreign Missile and Space Analysis Center (FMSAC) – when it was established on November 7, 1963, with a staff of 270. Headed by JAM SESSION colleague Carl Duckett, its charter was to provide detailed technical intelligence on Soviet, Chinese, and other foreign space and offensive missile systems. Determining the trajectories, range, number of warheads, and accuracy of ICBMs as well as the precise movements and missions of satellites and space shots would be FMSAC's job, with the assistance of OCS computers.[19]

Wheelon took another step to augment the Intelligence Community's analytical capabilities – by reaching an agreement with Lawrence Livermore National Laboratory to establish a Special Projects Division (eventually known as Z Division) to analyze the Soviet and then Chinese nuclear weapons programs. A similar arrangement was reached with Sandia National Laboratory.[20]

NRO AND CORONA

When Wheelon accepted McCone's offer to replace Scoville, he did so with three conditions. One was that OSI would be transferred to his directorate while a second was to replace "Research" with the more active-sounding "Science and Technology" in the title. The third was the most important – to reassert the CIA's role in the development and operation of space reconnaissance systems. McCone accepted all three conditions.

A necessary condition for the CIA to develop future systems was to 'stay in the game' – and that would involve two battles. One was over the CIA's role

15. [Deleted], Executive Staff, Memorandum for: Deputy Director (Intelligence), Subject: Report on DDS&T Meeting in the Auditorium on 6 August, August 14, 1963. CREST.
16. Jeffrey T. Richelson, *The Wizards of Langley: Inside the CIA's Directorate of Science and Technology* (Boulder, Co.: Westview, 2001), pp. 87-92.
17. Ibid., p. 93.
18. Interview with Brig. Gen. Jack C. Ledford, Arlington, Virginia, October 7, 1999.
19. Richelson, *The Wizards of Langley*, p. 79.
20. [Deleted], "Charting a Technical Revolution." Z Division's focus expanded considerably over the years, to cover the nuclear programs of India, Pakistan, South Africa, Israel and a number of other nations.

in the ongoing CORONA photographic reconnaissance satellite project, while the other concerned the authority of the NRO and its director over CIA reconnaissance efforts. The warring generals in that conflict would be Wheelon and Brockway McMillan, who had replaced the first NRO director, Joseph Charyk, in early 1963. His clashes with Scoville had helped drive Scoville out of the CIA, but they would pale in comparison to the battles with Wheelon and other CIA officials. The battle over CORONA began shortly after Wheelon's appointment as deputy director. In the view of CIA historians, McMillan "made a formal attack with a request to McCone that CIA relinquish all responsibility in regard to CORONA" – an action inspired, in part, by an October 22 memo from Secretary of Defense Robert McNamara that expressed his desire that the CORONA program be placed "under a single management system." McMillan followed directions from his boss with his request to McCone. In Wheelon's view, McMillan's memo "had the beneficial effect of clarifying their objectives ... With the gauntlet down, we faced an early test of McCone's resolve."[21]


CORONA photographic reconnaissance satellite.

McCone did not disappoint those who sought to resist any reduction in the CIA's role in CORONA. Through the rest of 1963 and in the ensuing years, McCone, Carter, and Wheelon would resist any suggestion that the CIA turn over responsibility for CORONA. As a result, in November 1964, McCone was able to write Deputy Secretary of Defense Cyrus Vance, noting their agreement that "CIA would continue its present

21. *Office of Special Projects, 1965-1970, Volume One, Chapters I-II* (Washington, D.C.: CIA, 1973), pp. 105-106; Robert S. McNamara, Secretary of Defense, Memorandum for the Director, National Reconnaissance Office, Subject: Policy Guidance on Management Control over Reconnaissance Programs, October 22, 1963, NRO CAL Records 1/A/0043; Letter, from Albert Wheelon to author, June 17, 1999.

responsibilities in contracting for all elements of the CORONA payload."[22]

Within a year Wheelon and McCone would win a victory that would make the battle over CORONA secondary, because it guaranteed the CIA its place in the development of future satellite systems. Just as the battle over CORONA went on for years, so did the battle over the broader questions of whether the NRO director should be, in effect, the czar of national reconnaissance – with full authority over not only Defense Department organizations, primarily Air Force, involved in designing and operating systems for overhead reconnaissance of denied territory, but the CIA's Office of Special Activities. That there was an ongoing battle required a certain defiance of the terms of the agreements between the DCI and Secretary of Defense over the NRO, as well as the May 1964 recommendations of the PFIAB. What Wheelon did not know about at the time was that McMillan had drafted a presidential directive, with McNamara's encouragement, that would have unequivocally made the NRO director the nation's reconnaissance czar. Upon reading the memo for the first time in 2007 after it had been released in response to a Freedom of Information Act request, Wheelon observed that "Whatever paranoia we had at the time was fully justified."[23]

Ultimately, a new agreement was reached in August 1965, in part because McCone was fully on Wheelon's side in refusing to cede authority over reconnaissance matters to McNamara and McMillan – at one point threatening to have the NRO abolished and actually drafting a proposed CIA-DoD agreement that would do so. The agreement that was reached guaranteed the CIA's future role in developing reconnaissance satellite systems and established an executive committee – consisting of the DCI, the deputy secretary of defense, and the president's science adviser to provide, as Wheelon put it, "adult supervision" for the NRO director. There was, according to a former member of the NRO staff, "peace in the valley" as a result.[24]

22. John A. McCone, Memorandum for: Honorable Cyrus B. Vance, Deputy Secretary of Defense, Subject: CIA Program B Participation in CORONA, November 17, 1964, NRO CAL Records, 1/A/0079.

23. Telephone conversation with Albert Wheelon, November 15, 2007.

24. Telephone interview with Brockway McMillan, September 15, 1999; Telephone interview with Albert Wheelon, May 19, 1997; Letter from Frank Buzard to the author, January 16, 1997; Brockway McMillan, Memorandum for the Secretary of Defense, Subject: Comments on the NRO and NRP, pp. 4-5. Despite their past battles, a few years ago the adversaries had a friendly and complementary exchange, starting with a letter from Wheelon to McMillan.

The 1965 agreement explicitly cleared the way for the CIA to continue work on an effort that Wheelon had initiated in 1963 – to find a significantly improved successor to the CORONA system. That effort began that October when he established the Satellite Photography Working Group, chaired by Stanford physicist Sidney Drell. Wheelon asked the group to determine the extent to which CORONA's resolution could be improved and how much intelligence could be extracted from images of higher resolution.[25]

The effort to replace CORONA, first designated FULCRUM, fell apart when the Itek Corporation withdrew from the CIA project – objecting to what it claimed was CIA insistence on requirements that it said were impossible to satisfy. Meanwhile, McMillan was pushing for a different program and the issue of a successor to CORONA became another issue in the ongoing battle between Wheelon and McMillan. Ultimately, Wheelon would find a willing and capable contractor – Perkin-Elmer – and in 1966 the United States Intelligence Board would give the CIA authority to develop the satellite it wanted. Eventually, it would be codenamed HEXAGON.[26]

It would be almost five years after Wheelon's departure that the first HEXAGON was launched, and not until overcoming further technical and bureaucratic challenges. But the first successful launch in 1971 would be followed by another eighteen successful ones through 1984, with vastly increased lifetimes, before the program ended in a launch-pad explosion in 1986.[27] The satellites carried four reentry vehicles and a camera that could produce images of thousands of miles of Soviet and other territory with a resolution of 1-2 feet.

It is generally agreed that HEXAGON was the most complicated spacecraft ever developed. But more important was its value as an intelligence system. A 1988 history of the program, prepared for the NRO, observed that HEXAGON "provided a unique collection capability which may never again be achieved by US imagery satellites. Its ability to cover thousands of square nautical miles with contiguous, cloud-free, high-resolution imagery in a single operation provided

25. Richelson, *The Wizards of Langley*, pp. 123-124.

26. Ibid., pp. 122-130.

27. Jeffrey T. Richelson, *America's Secret Eyes in Space: The US KEYHOLE Spy Satellite Program* (New York: Harper & Row, 1990), p. 361.

KH-9 HEXAGON Integration.

US intelligence users and mapping, charting, and geodesy (MC&G) organizations with vast amounts of nearly simultaneous contiguous coverage." HEXAGON imagery also provided "order-of-battle information across entire Soviet military districts...in a short time frame." In addition, Sino-Soviet military tactics could be determined from imagery of military exercises.[28] Increasing the ability to collect imagery of other areas of the world – whether the Middle East or South Africa – was a further benefit.

And, according to the NRO history, "one of the most significant contributions" of HEXAGON "was the confidence it provided national leaders in negotiating arms-limitation agreements with the Soviets and conducting negotiations for future treaties." HEXAGON was "of paramount importance in confirming or denying Soviet strategic weapons development and deployment" and could quickly detect "any new Soviet ICBM complex or development – such as mobile missile deployment." The information "was invaluable at the international negotiating table."[29]

Conflict had also come with another Wheelon initiative – this one with regard to signals intelligence. It began with Wheelon reading a newspaper article, in 1963 or 1964, that described the new Syncom II communications satellite, 22,300 miles above the equator. Wheelon thought a satellite in a geosynchronous orbit might be able to intercept telemetry signals from Soviet missile tests, signals which once interpreted could provide U.S. technical intelligence analysts with a wealth of valuable information about the characteristics and capabilities of the missiles. The program Wheelon initiated, designated RHYOLITE – and placed in the hands of Lloyd Lauderdale, a veteran of OSI's defensive systems division – also produced protests from the NRO director and his staff. They objected to the CIA's failure to provide detailed information about the project and suggested an alternative. Once again, Wheelon and the CIA would win the bureaucratic battle – and the first RHYOLITE would be orbited in June 1970.[30] And like HEXAGON it would be a critical element in facilitating the negotiation to arms limitation agreement – the successor to the 1972 treaty – in which the number of warheads permitted on each type of missile was a major element.

Another Wheelon initiative was the consequence of watching a football game from San Francisco, and wondering why intelligence imagery couldn't be transmitted as quickly as the exploits of quarterbacks and wide receivers. The need for such a program – which could eliminate the long wait between an image being recorded on film and its landing on a photo-interpreter's light table – was highlighted by the Cuban missile crisis. That work did not promise near-term results but work, primarily the responsibility of Leslie Dirks, began in late 1963.[31]

At the time of his departure Wheelon noted, in a prospectus he prepared for DCI Richard Helms, that the CIA's efforts in the field were being heavily outweighed by the work the Air Force was doing. However, "if we can keep our hand in that technology" – electro-optical technology that would allow the image to be converted into electronic signals that could be immediately transmitted to a ground station earth – a second chance might present itself.[32]

That chance did present itself, and with lobbying from Wheelon's successor, Carl Duckett, in 1971 the CIA received the approval to develop an electro-optical satellite. The program, codenamed KENNEN, would result in the first launch of a satellite with the KH-11 optical system in December 1976. It would further revolutionize U.S. satellite imagery capabilities in two ways. It would assure that the U.S. would almost certainly (baring satellite or ground station failure) have a continuous space imagery capability since there would no longer be a film-supply constraint. In addition, it meant a dramatic increase in the number of targets that could be imaged on a regular basis – from 20,000 to about 40,000 – again, because there was no need to worry about a limited film supply.

28. Frederic C.E. Oder, [Deleted], and Paul E. Worthman, *The HEXAGON Story*, (Washington, D.C.: National Reconnaissance Office, November 1988), p. 119.
29. Ibid., p. 120.
30. Richelson, *The Wizards of Langley*, pp. 109–112.
31. Frederic C.E. Oder, James C. Fitzpatrick, and Paul E. Worthman, *The GAMBIT Story* (Washington, D.C.: National Reconnaissance Office, June 1991), p. 87.
32. Albert D. Wheelon, Deputy Director for Science and Technology, Memorandum for: Director of Central Intelligence, Subject: Prospectus for Science and Technology, September 1966.

A STINT ON THE PFIAB

In late September 1965, Wheelon attended a meeting of the President's Foreign Intelligence Advisory Board to brief the board on the CIA's progress in implementing the board's recommendations for improving the agency's scientific and technical capabilities. Eighteen years later he would be attending meetings as a member of the board, having been recruited in early 1983.[33]

Service with the board continued until his resignation on July 1, 1988. During that period the board examined a wide variety of issues – including Moscow Embassy security, defectors and counterespionage, leaks and personnel security, human intelligence, economic intelligence, arms control, the Able Archer exercise, Bulgarian mobile signals intelligence collection, the attempted assassination of Pope John Paul II, information technology, Central America and the Caribbean, communications security, and the Strategic Defense Initiative and space technology.[34]

One aspect of space technology that Wheelon and fellow board member John Foster, who had served as the Defense Department research and engineering chief (1965-1973), examined was the use of the space shuttle for military applications. They concluded that despite its value for scientific and exploration missions, it had little potential use for military purposes. In 1985, Wheelon told an AFIO meeting that "I think the decision, which was made in the Carter years to compel the Air Force to rely exclusively on the shuttle, was a tragic mistake."[35] Wheelon's view proved all too accurate when, in January 1986, an explosion in one of the space shuttle Challenger's solid rocket boosters led to the death of all seven astronauts and would, for several years, limit America's ability to place spy satellites into orbit. (Wheelon would serve on the commission investigating the tragedy).

Not surprisingly some of Wheelon's attention was devoted to space reconnaissance matters. In one instance, he was asked to referee a dispute over the requirements for a follow-on signals intelligence satellite. The NRO's Program A had proposed a radical upgrade of the ORION signals intelligence satellites, the successors to the RHYOLITE system, while the CIA proposed a more modest upgrade. Director of Central Intelligence William J. Casey asked Wheelon and John Foster to weigh the merits of each proposal. Wheelon concluded that the extensive improvements suggested by Program A were not needed – that its staff had missed two key technical points – and the CIA proposal to stay with the same basic system and same contractor (TRW) made the most sense. Wheelon spoke to Gen. Ralph Jacobson, the head of Program A, who accepted his conclusion.[36]

Beyond refereeing disputes, Wheelon also pushed for increased innovation from the NRO. One particular suggestion was that the reconnaissance office explore the feasibility of a geosynchronous imaging system. Such a system, he pointed out, could defeat foreign denial and deception activities. Unlike low-earth orbiting imagery satellites that could be tracked by target nations, and whose ability to image a target was limited to certain periods of time, a geosynchronous system's imaging system could be pointed at any time at a large number of targets many miles apart. A potential target nation would have no way of knowing whether, at any given moment, the imaging system was focused on one of its nuclear facilities or a missile base a thousand miles away in another country.[37]

One evaluation of Wheelon's value as a PFIAB member is the 1984 'report card' prepared by PFIAB vice-chairman Leo Cherne. Cherne evaluated members of the board in five categories – attendance, substantive contribution, uniqueness of their contribution to the PFIAB, participation in task forces or individual study efforts, and balance and objectivity. Cherne was not an easy grader. Of the 18 members, six scored less than 20 out of a maximum 50, and another seven accumulated less than 40 points. Of the top five, with 40 points or more, Wheelon ranked first with 49 of 50 – receiving a 9 for balance and objectivity (the highest any member received) and 10 in every other category.[38]

LEGACY

One measure of Wheelon's legacy and stature is the identity of two of the men who spoke at his memorial service, held at a church in Santa Barbara on October 19, 2013 – just a few blocks from the Pacific Ocean. Richard Garwin and Sidney Drell have been key

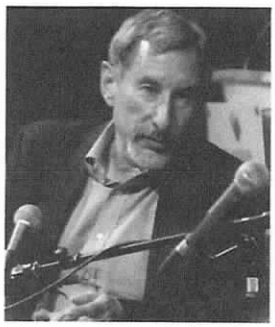
33. Kenneth Michael Absher, Michael C. Desch, and Roman Popadiuk, *Privileged and Confidential: The Secret History of the President's Foreign Intelligence Advisory Board* (Lexington, Ky.: The University Press of Kentucky, 2012), pp. 120, 235-236.
34. Ibid., pp. 246-259.
35. Ibid., p. 256.
36. Richelson, *The Wizards of Langley*, pp. 235-236.
37. Wheelon comments to the author.
38. Absher, Desch, and Popadiuk, *Privileged and Confidential*, p. 238.

advisers on intelligence and security matters for over half a century. Like Wheelon, Garwin is one of four individuals on which the CIA bestowed the R.V. Jones Intelligence Award – for special contributions to the use of science and technology in support of U.S. intelligence activities.[39] Drell, the chairman of the working group Wheelon established in 1963, continued to be a key adviser on national intelligence issues – along with Garwin he met with National Security Advisor Henry Kissinger in 1971 to convince him of the importance of the KH-11 program.

Drell began his talk by telling the audience that it had been his "great personal pleasure and privilege to have known Bud as a close friend" and that "he was a gentleman of total integrity and a dedicated patriot." He went on to note that "watching how Bud led and developed a strong program in his S&T Directorate that he was building at CIA gave me a deeper understanding of what an extraordinary individual he was." He also quoted former Defense Secretary William Perry, another R.V. Jones Award winner, who had stated that "the national reconnaissance systems which the United States now has which are truly jewels in our crown, all stem, in my judgment, from the creative work that Bud Wheelon did in the 1960s."[40]

Today, the organization of the Directorate of Science and Technology is quite different and diminished from the one Wheelon and his successor, Carl Duckett, had established. The analytical functions of the Office of Scientific Intelligence and FMSAC were transferred to the intelligence directorate decades ago. The Office of Special Activities was shutdown in 1974, with the transfer of the CIA's U-2 program to Air Force. Activities performed by the Office of ELINT now reside in the Office of Technical Collection — but the most important of the office's assets, the Iranian stations at Meshed and Beshahr, are, for obvious reasons, gone. But most disturbing to some has been the disestablishment of the Office of Development and Engineering – the successor to the satellite-oriented Office of Special Projects.[41] One former deputy NRO director wrote Wheelon expressing his concern about that development.

But even if the bureaucratic structure is gone there are more important legacies. Part of that legacy can be found in the National Museum of the U.S. Air Force, where a HEXAGON satellite is on display – representing the 19 successful missions and millions of miles of target territory imaged during those missions. In addition to the legacy on the ground there is the legacy in space – involving currently operating systems. America's key imaging system – which watches everything from Iranian and North Korean nuclear facilities to terrorist training camps to Chinese military developments in real time – is a direct descendant of the work on electro-optical real-time imagery that began during Wheelon's tenure. Similarly, a key element of the NRO's signals intelligence constellation is the ORION satellites, the successor to the RHYOLITE spacecraft. Thus, while the offices at Langley may no longer be there, the jewels in the crown that William Perry spoke of are still there – many miles above the earth.



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39. Wheelon was the second recipient, in 1994, following the initial 1993 award to the British scientist it was named after – Reginald V. Jones. Two other key intelligence honors Wheelon received were being named a CIA "Trailblazer" as well as a NRO "Pioneer of National Reconnaissance."

40. Sidney Drell, "Remarks for Albert "Bud" Wheelon Memorial, Santa Barbara California," October 19, 2013.

41. John P. Stopher, "The Essential Revolution of the NRO," *Space News*, October 14, 2013, p. 19.