第七章　最后的时刻

在新疆维吾尔自治区的茫茫沙漠中，隐藏着中国的核武器试验基地和导弹弹着区。就在靠近死神般的军事战略禁区的地方，中国的考古学家们最近竟挖掘出被长期埋葬的古代王国的的遗址以及运载丝绸的商队的车辆。库尔勒、民丰（古称尼雅）、焉耆（古称阿格尼，后又称卡拉沙尔）以及罗布泊等地区都归属于核武器试验基地。这不禁使我们联想起西汉军队曾在这里大战过匈奴；联想起在罗布泊沼泽的西部边缘、楼兰古王国拥有的一片绿洲以及当年马可·波罗沿着丝绸之路进行的冒险旅行来到这里等情景。在13至14世纪的蒙古帝国统治时期，成吉思汗将相当于现今的新疆的大部分领土作为一块偏僻的封地封给了他的二儿子。在伦敦英国博物馆的大厅里和列宁格勒的一所博物馆中陈列的几件有关这些历史事件的珍贵文物，正是现代考察者寻找军事区时所发现的古迹。[1]

罗布泊

新疆，这个中国西北部的省份，现在是一个自治区；这个名字的含义是“新的疆土”。新疆包括广阔的塔里木盆地和准噶尔盆地，以及雄伟的天山山脉和昆仑山脉。它的面积占全国的六分之一。[2]古代历史和现代状况的融合，使得这片土地笼罩上一层更加神秘的色彩。很久以前，这里就是一个各民族聚居的地区。汉人从东来到这里，蒙古人以及一些闲散部落从北来到此地，斯拉夫人和其它一些人越过帕米尔山而来，欧洲人从西边而来，印度人从南而来。丝绸

之路越过帕米尔高原，向东进入新疆后，分为南北两线：一路穿过天山南侧的广阔绿洲，另一路沿着昆仑山北侧的水湾向前。这两条路线在甘肃的安西会合。那些来自新疆偏僻地区的游人，沿着丝绸之路到达安西后，仍未停止其冒险的行动，他们重新考虑了自己的行动方向并发誓还要回来。

在寻找中国的核基地时，这些古代遗留下来的踪迹延长了人们搜寻的时间，丰富了他们勘探的内容。新疆这样一个边远地区，虽然是中国人在这里选点的原因之一，但最使人满意的是这里干枯荒凉的茫茫沙漠。5 世纪期间，僧人法显自西北探险到达了后来以其艺术和文化财富闻名于世的敦煌要塞。接着他来到了阿格尼，即现今位于罗布泊核武器试验基地西侧的焉耆——一片常青的绿洲。在那里他遇到了小乘佛教学校的 4000 多名和尚。他对那里的人的印象是："缺乏礼貌，对待客人冷淡。" 200 年后，唐朝的一位高僧玄奘又来到阿格尼，并参观了阿尔汗-布拉克（"师泉"）。传说这里有一个和尚，在他进入极乐世界以前，从干硬的岩石上引来了一股泉水。[3]最后，穆斯林的神话战胜了佛教的教义，从而使维吾尔族、哈萨克族、乌孜别克族以及汉族的人们都更加信仰伊斯兰教了。

13 世纪，马可·波罗沿着南侧的丝绸之路向中原帝国进发。途中他经过了罗布城（现在的若羌），然后，他沿着甘肃走廊来到了安齐纳镇（音译）。在罗布城，马可·波罗回忆说："众所周知，这浩瀚的沙漠就是凶恶之神的乐园，它以不同寻常的方式——离奇的幻觉，愚弄着旅行者们，破坏他们的行动。"在罗布沙漠的一些人所看到的海市蜃楼是"一队全副武装的人们向他们扑来"。他还写道："这些'沙漠中的魔鬼'使用各种乐器产生轰鸣，整个空间充满着鼓声和兵器的撞击声，把人们弄得不知所措，置人于死地。"马可·波罗认为，在安齐纳，即位于导弹试验基地内，现今已被毁灭的"黑色城堡"克拉克赫塔（音译）中的居民是一些盲目的神崇拜者。他们的土地充足，以致"对商业往来毫不关心"。[4]

地图 4　新疆维吾尔自治区(部分地区)

本章所附地图4的中间部分是中国最禁闭、最鲜为人知的区域，它是介于天山山脉和库鲁克塔格山脉之间的盆地。雷金纳德·斯柯巴格（音译）作为20世纪20年代西方极少数有幸到过这一地区的一位参观者，记述了他对这一地区的印象。他回忆起当时的传闻，认为罗布泊盐水湖西北侧的库鲁克塔格山地干旱异常，以至于在汉代就"毁灭了楼兰王国"。[5] 然而事实上，像先前的奥里尔·斯坦因先生一样，斯柯巴格也发现库鲁克塔格的山丘并不像人们想象中那样干涸。[6]他回忆说："正如库尔勒人告诉我们的那样，这地方很美。""所谓干涸或干旱实际上是名不副实。"他写道："茂盛的树林和绿草就是一个证明，大叶钻天杨很多，长势很好，草木也长得相当好。从库拉沙赫尔（音译，现今焉耆地区）到库鲁格德克（音译）的地带，是蒙古牧民的一块越冬牧场"。[7]

斯坦因也被这景象惊呆了，他描述他所见到的是"这贫瘠的红色的库鲁克塔格山峰振奋了人们的精神"。在这被传说为寸草不生的地方，斯坦因·罗布莱克的劳动者们找到了水，为他们的骆驼建起了牧场。初次见到了古时代占领期的踪迹。[8]斯坦因的助手勘测了从库鲁克塔格山北侧到寸草不生，唯有鸣禽才能长期定居的距现今的核武器爆炸区只有几公里的广阔地带。[9]这片禁区的沙漠迎来了中国的秘密核武器试验场和一个与之相关的科学城的建立。

如今试验设备要通过位于省会乌鲁木齐东南的吐鲁番地区和巴音郭楞蒙古自治州的边界。尽管19世纪俄国探险家迈克尔佩夫佐夫曾经传播了一些当地的文化历史，但人们仍然对新疆维吾尔自治区这个人烟稀少的地方知之甚少。[10]据迈克尔佩夫佐夫估计，19世纪前，生活在整个罗布泊盆地的人口仅有800人左右。像库鲁克塔格北侧的人一样，他们绝大多数都是塔吉克人或蒙古人的后代，塔吉克人在他们成批地涌入蒙古人居住区的400年前就来到这个地方。[11]渐渐地，游牧的蒙古人离开家园，向其他地方漂游，去寻找更易于狩猎、放牧、捕鱼和喂马的地方定居。[12]这些牧民成群结队地进

入一些只有一二十户人家的居民点住下，靠采集野果为食，艰难度日。这些蒙古人虽然远离家乡，但比起为数众多的远方的维吾尔族兄弟，带有更浓厚的东方人的特点。[13]他们仍然保持着蒙古族的婚丧嫁娶习俗。直到现在，他们还仍然如此。在那个时期，只有守卫要塞的中国士卒，或是在与世隔绝、城堡一般的监狱中看管流放政治犯的看守，才远离家乡。[14]由于在这片土地上建立试验基地和进行核武器试验，所以这些柯尔克孜族——蒙古人以及汉人的混合民族的后裔面临着不得不再次迁移的巨大冲击。

我们还必须强调一下，这里人烟稀少，与世隔绝。在这一地区，柯尔克孜人的告别辞“雅尔·保尔桑”（音译），即“祝愿有条出路”包含着特殊的含义。狂风卷起干硬的尘沙，呼啸着从东北刮向西南。绵延不断的山地被一道道深深的裂痕分割开。狂风掠过这片干裂的土地，嘲弄着那些想筑路的工人。[15]汉代的历史学家把楼兰的这一恐怖地区称为“白龙岗”[16]。

对这一地区的历史、恶劣的天气以及特殊的地质条件的考察，为开拓核武器试验基地铺平了道路。中国领导人以革命胜利者的姿态第一次回到了这片土地上。1949 年 5 月，正当内战即将结束之际，在彭德怀指挥下，在西北发起了一次重大战役。有一次，彭率领的西北人民解放军，后改为第一野战军，险些遇到埋伏，只是由于在关键时刻聂荣臻的部队及时赶到，才化险为夷。后来，这两支部队联合作战，但在甘肃、宁夏和青海等地的几次战役中付出了很大的代价。[17]

1949 年秋天，毛泽东令他的驻莫斯科的代办邓力群去新疆，察看是否能利用谈判使那里的国民党军队投降。9 月，国民党指挥官同意了投降书上的条款。10 月，彭德怀的第一野战军第一兵团司令员王震派遣部队去占领这个省。就在这时，国民党军队在一次与苏联的东方土耳其斯坦人民军作战时被包围了。经过几个星期的密谋，莫斯科方面迫使国民党部队交出了武器，并将其归属到彭的部队。这

支国民党的军队投诚后，彭的部队就完成了占领新疆的全部任务。[18]

到1954年，第一野战军的许多部队，包括前面提到的国民党军队，有的被解散，有的被重新编成生产建设兵团，留在新疆。[19]从1954年底到1957年，建设兵团的人数从20多万增加到30多万。[20]新疆的军政负责人王震遵照1949年12月5日毛的指示，从1950年开始将自己的战斗部队逐渐转变成生产部队。[21]几万名复员军人被安排到塔里木和准噶尔盆地的绿洲中进行生产劳动。他们对沙漠进行改造，建设新的军垦农场，完善通讯设施，绿化种树，挖井蓄水，水土保持以及水利灌溉等工作。耕种、采矿、小型加工和基地的城市化建设等，也是兵团所要从事的主要任务。

一些转业的部队还担负保卫边疆和公共安全的工作。他们装备小型的武器，担负当地的守卫任务。同时，他们也培养党的干部，以加强本地区仍不稳固的领导部门的力量，负责政治思想教育和战斗动员。这些以汉族为主体的复员军人组成了北京的首批移民迁入中国的西北部，于是北京继续执行清帝国[22]的政策。

1956年，当时任中国人民解放军铁道兵司令不久的王震被委任为国务院农垦部部长，新疆建设兵团的主要工作由原王震的部下王恩茂领导。不久，二王视察了战略核武器试验基地的部分工程。该兵团配有大型的机械，是构筑核试验区周围的设施和安装导弹试验有关设备的骨干力量。

寻找试验基地

1958年8月10日，一列火车满载着经过精心挑选的官兵从河南的商丘向西北进发。[23]他们从出发前接到的简短命令中得知，北京方面命令他们快速开赴西部地区，并在那里为一秘密设施寻找一块合适的地方。命令既没有说明他们的最终目的地，也没有告诉他们完成任务时间的长短。困惑和各种猜测笼罩着所有车厢，但是没有

一个战士能猜出这支部队的真正任务是什么。

这列火车到达的第一站是历史名城——甘肃西北部的敦煌。这时部队离开河南已有10天了。部队下了火车，走向附近的一片戈壁滩，对这里进行较精确的土地测量。一个星期以后，即8月底，在敦煌的电影院里部队党委和领导召开了全体勘测人员大会，那时人们才知道他们来西北的原因。他们的任务是为核试验基地挑选一块地方，并作为核心力量去建造它。这真是一个激动人心的消息："会场的气氛一下子活跃起来，一些同志甚至激动得流出了眼泪。"所有的人都下定决心尽自己最大的努力为中国原子弹和氢弹的发展，为中国国防的现代化贡献出自己的一切。

然而，当部队进入一望无边的戈壁沙漠后，那种激昂的探险气氛很快沉静下来。在这片荒凉的土地上所遇到的困难是他们没有预料到的，他们需要建立长久性的营地，而对营地的要求常常限制了他们的选择。可是，他们仍然勇敢地接受挑战，去完成他们的使命。在以后的3个月中，他们一直对沙漠进行勘测，搜寻着可行的靶心区、生活区以及指挥所。

10月，中央军委任命张蕴钰为试验基地司令员。11月，勘探队选定了可能成为基地的一些地点。于是，张从北京飞到敦煌进行现场视察。分配给勘探队的苏联专家特别提出把基地定点在敦煌西北140公里远的地方。他们还详细地说明了建立一个最大爆炸当量为2万吨级的基地规划。他们声称，对于中国的核武器计划，这样一个规模已足够了。

经过对地质、地形、公路设施以及水源等各种因素的综合分析，把各个选择对象进行比较，最后张认为没有一个地点合适。考虑到美苏已经试验了百万吨级的核武器，他否定了2万吨级为极限的想法，认为这样的规模远远不能满足中国的需要。他还断定整个试验区缺乏足够的水源和交通运输。所有可能的候选地点都离敦煌太近，这势必由于放射性尘埃的漂散而危害到这座城市。而且从靶心区到

生活区和指挥区的方向是顺风的。因此，张虽不情愿但仍然果断地否决了所有可能和选择，并将自己的意见报告给北京。

12 月，北京方面接受了张的意见，并命令继续向西寻找合适的营地。于是，张在敦煌设立了指挥部，并派遣河南勘测队沿途勘探。不久，航空勘测队在敦煌的西北方向约 550 公里的新疆吐鲁番地区建立了临时的管理机构。由于没有塔克拉玛干沙漠以北这片未被勘测地区的合适的地图，张便命令航空勘测队进行最初的勘测。飞机从东面的哈密机场起飞，尽最大可能对罗布泊沼泽地的北部和西北部地区进行了空中测绘。12 月中旬，飞行员们标记出一些可能的基地候选区。12 月 22 日，张再一次派遣他的勘测队进入沙漠。每一队大约有 20 名战士。所有地面勘测队彼此之间通过无线电保持通讯联络，并用无线电与空军保持联系。他们乘坐着吉普车走遍了这个古代楼兰王国的疆土，他们基本上是沿着古代的丝绸之路，在焉耆、吐鲁番和焉耆、罗布泊之间往返。

1958 年至 1959 年的冬天，一支勘测分队来到黄羊沟绿洲。勘测队员们对这里的地理情况进行了详细地了解，包括它的地形、水源、土壤等情况。他们对黄羊沟的发现非常高兴。这一地区依靠着北面那高耸入云的天山山脉，围绕着绿洲形成了一大块沙漠谷地。谷地东西长 100 多公里，南北宽 60 多公里。周围的地区看来也有发展希望，所以张蕴钰司令员便于 1959 年 3 月将整个指挥部从敦煌迁至吐鲁番。

与此同时，勘测队员为以后的科学中心和生活区做了一些初步的研究，接着他们在盆地底部开始寻找靶心地区。对于这一有关全局、极其重要的位置的确定花费了几个月的时间（从 1958 年冬天到 1959 年的春天）。技术上的要求是：爆心应选择在既离指挥所较近以便于直接观测，而又不会危及观测者的安全。按规范要求，离指挥所 50 公里远的地方是一个最理想靶心区，但这一距离太近而不能保证避免散落的放射性物质的危害。一个勘测队在 90 公里远处发现一

个地方，但是直接观测又出现了问题："当时他们派去两辆满载着易燃木料的卡车到那里，浇上汽油把它们点燃。然而，那些留守在指挥所里的人员即使借助经纬仪也看不到烟雾。"最后，在离指挥所70公里远处找到一个地方，并定点在那里。在选择靶心区的整个过程中动用了1000多人，花费了2年的时间，最后确定靶心区位于北纬41.5°，东经88.5°的地方。

基地建设

正当寻找靶心区的工作紧张进行之际，1959年6月13日，也就是罗布泊核试验基地正式建立（10月16日）前4个月，基地筹建党委召开了它的第一次扩大会议。[24]张蕴钰部下的基地领导人会聚在基地临时中心的一个地下室中。因为据推断，代表聂荣臻来视察工作的张爱萍正好住在这里，于是这个地方便成为众所周知的将军别墅和基地领导制订几乎所有决策的场所。[25]最后，张爱萍担任首次原子弹试验的现场总指挥，他的指挥权限高于试验基地的指挥权，并同第九研究院保持着联系（见图1）。同时，张爱萍还担任首次原子弹试验委员会的主任，这一机构的级别又高于前者，它可直接向毛泽东的中央军委和周恩来领导的15人专门委员会汇报情况。[26]

一个面积为10万多平方公里，相当于中国东部的浙江省[27]大小的地带被用来建造试验基地。几年来，随着试验计划的进展，在爆心区附近进行了地爆、近地爆（在塔上爆炸）、空爆（飞机投弹或导弹发射），平硐、竖井等爆炸试验。经过多次的试验，靠近爆炸中心的地区变成一片废墟。按照试验基地的一位前任指挥官命令："在试验基地修筑了2000多公里的公路（截至1984年）。在每一试验场区要配备一个指挥中心，一个通讯中心，一个控制中心和一个永久性的观测站。在空爆试验场区，还要建造一些简易的房子、机场和铺设地下水管。在一定的距离内，还有一个飞机场和一个工厂以配合各项试验。直到今天，仍有一些设施在继续使用。过去试验留下的

各种密密麻麻的弹坑、散落和废弃的碎片已成为先前爆炸中心区的见证。两名参观了这一地区的记者描述了呈现在他们眼前的景象："被炸毁的汽车变成了一堆堆废铁；飞机只剩下了残骸；被破坏的水泥建筑物，它们的一部分表面呈现一层熔融的玻璃状。1960年初，张蕴钰部队的目标就是朝着能产生上述核爆景象而进行试验。

三年困难时期，罗布泊基地上的人们也需要付出代价。[28] 1960年，饥饿和营养不良严重地危害着基地的建设者们。库存的蔬菜很快被吃光了。为了不挨饿，基地大多数人员不得不依靠吃榆树叶子和采集野菜度日。由于缺少雨水，使得基地人员想自己种粮食的希望化为泡影。解决粮食短缺变得特别地困难。塔里木盆地北侧的这块沙漠谷地除了与外界隔绝和土地荒芜以外，每年平均降水量只有16毫米，而年水蒸发速度却达到3600毫米左右。人们在饮水、洗衣、做饭时，随时都能看到水汽蒸发。因此，在这里每一滴水都必须用于吃住两个方面。

在一段时间内，建设工作集中在公路的修建、水源的保护和其他公益事业上。中央军委精选了一批工兵部队和铁道兵部队去完成基地的主体工程建设项目。同时又派出生产建设兵团下属的几支部队去修建周围的永久性设施，用来保障基地的通讯畅通。我们曾拜访过几名现居美国，曾在新疆生产建设兵团的第二农垦师下属某团（该师共有10个团）里服过役的战士。[29]从他们那里得知，这个师派遣了一些人员参加修建试验基地和导弹弹着中心区的通讯网络。每一个建设兵团都配有自己的农场、工厂、医务所、后勤补给部门以及一支特殊的机械化建筑工程部队。每个团都有几千名农垦战士和一支相当数量的家属队伍。

一个团的10到20个连中，只有4个或5个连是由发给枪的志愿参军的青年组成，其它的许多连队，也许不是大多数，是由战士和囚犯混合组成。[30]从我们对这些士兵的采访情况来估计，10万人中大约三分之二是在押劳改犯或刑满释放犯。这些人不发给武器，他

们的任务，尤其是那些从前的国民党兵，被认为是一次艰巨的劳动改造。在50年代，许多连队都由以前的国民党兵和普通犯人组成的被称为“新生连队”的队伍。[31]那些被划定为囚犯的人失去了他们的政治权利，不得不在武装战士的监督下卖力地劳动，连队里的武装战士对于自己的薪金比别的部队高而感到满意，他们能得到特别津贴，并且从繁重的劳动中解脱出来。

分配到核导弹试验基地的机动工程队被编在一个师属的工程支队下。他们的组成很特别，聘请了许多少数民族同志，这是由于1962年5月发生的伊-塔事件的结果。就在那时，中苏边界上的局势相当紧张，中国政府宣称苏联人已经煽动了几万名伊宁自治州和塔城镇的当地少数民族群众逃到苏联（因此该事件称为伊-塔事件）。这个事件的后果，使得中国政府几乎把所有留下的少数民族群众从伊-塔地区迁移到自治区内部，同时，那些能够从事体力劳动的人被集中到一起作为工程支部的后备力量。这些伊-塔的建筑工人们得到了优厚的待遇，包括很高的工资以及同边防军享有同等的优惠。

工程支队和其他人员共同在试验基地周围建起了城镇和通讯系统。[32]马兰就是其中的一个，它已出现在中国的地图上。工程师们把它建在乌什塔拉和榆树沟两个新开拓区公路的汇合处。该城除了包括居民住宅和营房建筑以外，还建造了一座机场，一家医院，一家银行，一家商店，几家旅馆，一座邮局和一个接待中心，它可作为周围居民的一个娱乐和旅游中心。马兰已成为罗布泊核武器试验基地的总部所在地（首府）。[33]

公安部队禁止参观者向马兰城外的北部（属于严格控制）地区前进。在这个科学研究区里，来自河南的部队中的工程兵（并非建设兵团）的特种建设部队完成了几乎全部的施工任务。位于马兰市中心西北几十公里、靶心区西北约200公里的天山脚下的一片谷地，已经成为核武器研究和试验的现代化的科研中心。聂荣臻为这个中心里的中学和幼儿园题了词。除了这些题词，以及进入该地区内部

所要受到的种种限制以外，再没有什么特殊的标志可以把它与中国其他新兴的城市区别开来。建设者们在这个严格保密的地区建立了一个研究所，致力于流体力学、固体力学、光学、物理学、放射化学、计算以及数据处理等方面的研究。从1963年建立以来，该所保存了有关核爆炸，反核战争，核武器的设计等方面的大量档案资料。近千份关于核爆炸试验结果的技术资料被划为“绝密”等级，并保存在档案中。基地的全体科技人员坚信：“与世界上其它有关国家一样，他们能成功地建立起一所他们自己的研究核武器的院校”[34]。

我们曾拜访了以前在生产建设兵团的一名工作人员，据他说，外人只知道马兰以北的某一地区是高度保密的。从外面来的车辆必须换由公安部队的驾驶员驾驶。进入该地区通常要换三次驾驶员。外人也可能还知道核科学家住在里面，还有为核试验准备的猴子，狗、老鼠、山羊等动物也养在里面。根据我们采访过的那些人员介绍：“有关这一地区的许多故事在当地群众中广为流传。”当然不包括机密内容。

到60年代中期，中央军委批准从工程兵部队和铁道兵部队中抽调一些建设队伍来扩建基地的工厂和总体工程设施。到1967年初，这些部队已建成了一个供运输机、中程轰炸机使用的空军基地以及一套基地专用的铁路系统。[35]

参加一次特定试验的人员在“几千到近万人”，科学试验区里的各单位要保持适当的稳定。[36]来自中国的消息说，试验区内的通讯保障人员、运输队以及阳平里（音译）气象站的工作人员，面对新疆沙漠中的酷暑严寒，一次次为试验作出了贡献。[37]几年来，随着基地的发展和完善，个人和家庭生活方面的问题就变得同科学研究以及为下次试验所要做的准备工作几乎同等重要了。一个意想不到的问题是，受过高等教育的女科学家、女工程师、女护士以及办公室工作的女职员的人数超过了可追求的男性的人数。每年毕业的时候，一批新来的年轻男科学家和工程师要被分到基地工作，这每年一次的

机会，却导致出一场爱情婚姻的竞赛。据报道说："这真是一个奇观，好像女孩子和她们的父母都在尽最大的努力来赢得一位年轻的小伙子"[38]。

于是，几年后，这个边境上特殊的基地扩大了区域，超出了核武器试验这一范围。像中国古老边境上的城堡一样，这一科学试验区逐渐变成了当地社会活动的中心，构成了一个完整的社会体系。它的特殊使命是把中国的科学和技术结合在一起，并始终保持其强大的力量，以适应当今的政治局势。

第一枚武器的到达和最后的准备工作

1964 年，原子弹的爆炸试验成为科学城和整个基地压倒一切的任务。[39]随着炸弹在酒泉装配厂的组装完成，关于原子弹及其装配人员将要到来的消息传遍了罗布泊试验基地。作为第一颗原子弹爆炸试验总指挥的张爱萍，加强了同周恩来总理领导的 15 人专门委员会以及在青海的第九研究院领导之间的联系。

为了安全起见，工程师们将炸弹分拆成两部分。一部分用火车运送，另一部分由飞机运输。周恩来指示："一定要保证第一颗原子弹装配、运送和爆炸的安全"。为此，第九研究院的一位高级领导干部吴际霖竭尽全力地遵照总理的指示去完成任务。一辆由中国最优秀的司机驾驶的专列已经准备就绪，它将运送没有核爆炸装置的部分。一位主要负责人向吴保证："分配给一号特别机车的所有煤都有专门管理，以便从中挑出在煤矿中可能混进的雷管或其他任何爆炸物。"这意味着工人们要把 100 多吨煤检查一遍。在沿甘肃到新疆的铁路线上，"所有的火车都要为这趟特别列车让路，横越在线路上的高压输电线切断电力供应。"同时，吴还注意到给派去检查特别列车的工人每人发一把特殊的铜锤，用它不会产生火花。等到特别列车装上设备出发时，所有的铁路人员和安全工作人员已经对所有可能发生的偶然事故进行过多次演习。

北京当局特别关心将于8月底离开酒泉总装厂的专列的安全。[40]一节车厢里除了装有炸弹的组件外，还有将要参与第一次试验的第九研究院的专家。在甘肃到新疆的铁路线上，两省的公安局的领导在各自的管辖范围内加强了对列车的保卫工作。他们提供给与王淦昌一起去罗布泊试验基地的吴际霖一份详细的预定行程表和关于采取安全保卫措施的具体条目。在两省交界处，吴和王"被窗外站台上移动的景象吸引住了"。当火车通过时，他们看见一行行铁路干警和安全保卫官员像"雕像一样笔直地站立着，坚守在岗位上。"公安部的领导说："从昨晚起他们就站在这里了。"

在甘肃和新疆的每一站，吴际霖都要参加安全部门对爆炸装置的安全检查。负责安全的官员和技术人员仔细观察各部件和专用的控制台。每当列车重新启动时，吴都要求不断地向他报告关于整个路段的天气情况，列车的震动状况以及关于铁路上每一处"危险"拐弯的情况，他还亲自检查设备容器的放置稳定状况。吴同列车的司机保持着直接联系，以便能命令列车以较低的速度前进来减小震动。就这样，经过漫长的铁路运输，非核装置被运到了试验基地，然后由卡车运到靶心区。

在非核部分被运到罗布泊试验基地的几天后，聂荣臻命令飞机运送核芯体。二机部一位胡助理研究员和二机部保卫部的高副部长担任押送任务。在西行的途中，当了解到所押送的货物是什么以后，保卫部的高副部长十分关心核装置是否可能会过早地发生链式反应的问题。他问胡："宇宙射线对设备会产生什么影响？"胡向他保证，不可能产生链式反应，然后又立刻继续监测仪器。这使得那位副部长变得更加紧张。整个飞行过程中，他反复提醒胡要测量宇宙射线的剂量。当飞机降落在罗布泊试验基地后，高才长长地松了一口气，显得很轻松，因为他能够把核装置交给第九研究院的领导李觉（九院院长）和吴际霖了。

即使飞机安全着陆在基地后，在装卸过程中，也是把安全放在

首位的。飞行员和机组人员卸下装有铀芯的密封容器，并将它放置在一辆卡车上。当它被运到试验场后，在实验场的领导、几名工程师和保卫部门官员的监督下，才由胡打开保险锁，取下核装置。当这些人员核查无误后，他们便代表装配队接收并承担了保管核组件的任务。

在张爱萍的全面领导下，基地司令员张蕴钰和科学家程开甲全力以赴地为整体试验做最后的准备工作。[41]在那年的夏季，当部件运来之前，人们已经在沙漠上竖起装有卷扬机的铁塔，卷扬机可将原子弹升到 120 米高的塔顶。在铁塔周围，工人们开始放置一系列探测器，铺设电缆以及安置试验用的动物和军事装备（包括飞机、坦克、大炮和舰船上的设施）。这时，各级军事领导和观察人员开始到达。第九设计院的领导——李觉、吴际霖、朱光亚和王淦昌仔细地检查了整个试验场区、铁塔和靶心区的其它设施。

准备期间，在一次试验区空中检查过程中，发现了意外的情况。图象中显示出附近有人居住。负责安全的官员马上命令进行仔细的调查。几天以后，一支小分队发现了一个露营地。搜查继续进行，直到晚上，搜索人员偶然发现了一群衣衫褴褛的国民党败兵。他们自 1949 年起一直逃亡在此。“他们都是男性，面容憔悴，衣服破烂，步履蹒跚。一个小孩拼命地哭喊，大人们粗鲁地咒骂着”。这些人是骑马逃跑的。小分队总共花了 3 天多时间才跑遍靶区周围的 200 个隐居处。[42]

除此之外，其他一切都按计划顺利进行。张爱萍作为第一颗原子弹试验委员会和第一颗原子弹试验现场指挥部的领导，对现场的试验工作负主要责任。[43]他和刘西尧副部长（现场副总指挥）亲自视察了铁塔。在和李觉一起登上塔顶时，张问道：“你能保证安全可靠地把炸弹从地面送到塔顶吗？”李作了肯定的回答，而那些“自愿参加核试验的人员早就多次空手爬到铁塔顶部了。”

在确有把握的情况下，张命令用模拟弹对预定的所有程序进行

最后一次演习，8月份曾进行过这样的演习。正当演习进行之际，一场强烈的暴风忽然袭击了靶心区。少有的、异常凶猛的狂风冲击着还在铁塔上的工作人员；但是，李觉命令演习继续进行。在铁塔脚下的一顶帐篷里，李觉、吴际霖以及其它人员用电话与继续工作的技术人员保持着联系，并命令他们在整个狂风之夜严密监视各种仪器。一阵无情的大风把铁塔上的卷扬机吹坏了。为了解决塔上工作人员的饮食，李觉命令从技术部队中精选出的几名战士带上食物和水爬上塔架顶部。拂晓时分，随着暴风停息，模拟演习也结束了。张宣布除了卷扬机发生事故以外，这次演习非常成功。

这时，只有两项准备工作仍在进行：检查计算数据和确定爆炸零时，前者在爆炸前一天进行。由于张爱萍十分担心点火失败的可能性，所以他又给二机部发了一份“紧急电报”，要一份最后的计算资料。他想让在北京工作的第九研究院的理论物理学家保证，依据他们的计算结果试验成功的概率在99%以上。虽然大多数技术数据已送到试验基地，但刘杰部长还是立刻指派周光召和另外两位数学家来完成这项工作。数据上的差异使得以周光召为首的三人小组必须凭借着记忆，对早期的工作进行重新计算核实。为此，他们加班加点地工作，终于在第二天清晨，把数据送到靶心区。周和他的组员们在中央委员会的备忘录上签上了各自的名字，证明试验成功的概率能够达到99%的要求。从那时起，爆炸零时也就确定了。

中国的一份报告中曾提到一个姓杨的青年技术员，在1964年10月1日晚——中国国庆节这一天做了一个梦。当他醒来后，他冲出帐篷，大喊道：“党中央已经审定通过爆炸时间了！”蔡工程师和他的同事们被杨的叫喊声唤醒，忙问：“出了什么事？”“杨技术员做了个梦。”这时，杨激动地喊着：“我梦见党中央已经确定了爆炸时间，它包括3个‘十五’。”“3个‘十五’？”人们不解地问。杨一下子把他的同事拉到一起说：“第一个‘十五’表示中华人民共和国成立15周年；第二个‘十五’表示今天是10月1日，从今天起往后

数 15 天即 10 月 16 日；第三个‘十五’意味着原子弹在那天的 15 点爆炸。”

几天后，中央委员会审查了长期的天气预报后宣布了第一颗原子弹的爆炸零时：10 月 16 日 15 点整。基地内没有人对此感到惊异，不管这梦是不是真的，杨技术员做梦的故事已经成为那些亲眼目睹第一颗原子弹爆炸的人们的口头语了。

爆　　炸

起爆最初的代号“投篮”的密码命令是 15 日发出的。[44]这一代号是基地的篮球运动员们提议的。它的意思是：把铀部件和点火装置放进爆炸装置中。在此之前，从酒泉原子能联合企业运来的部件已经放在试验基地的装配车间里。在开始装配时，只有 5 个人被允许呆在这个地下车间里。李觉认为他应当是这 5 个人中的一个，“以便使那些从事危险工作的人员心里更踏实一些。”两天前，技术人员已经把爆炸装置装配起来。现在，他们中的 4 个正把核部件安放进去，用螺栓把整个装置联结起来。李觉称赞他们的工作做得完美无缺。

现在，炸弹已经部分组装完毕。中国方面声称他们并不着急引爆，[45]事实上，的确如此。根据他们自己的说明，他们已经为试验做了全面的准备，并对工作人员也采取了保护措施。在这首次的原子弹爆炸试验中，最大可能地保证安全是很值得称赞的。当技术人员把炸弹部分准备就绪后，不必要的人员都撤进了掩蔽部。几千名参与试验工作的人员只有一少部分继续留在靶心区。[46]在 15 日午夜前，核装置整体安装完毕。从部里安全防护局来的安全检查人员决定不通电，不安雷管。

尽管周恩来命令从防化兵和医疗队来的工作人员测定放射性沉降物(使用血液样本检验)，并估计它给暴露的平民带来的不良后果，但是用来防备爆炸以后带来的危险的预防措施显然是太少了。[47]在这次和以后的试验中，负责安全的专家们意识到与大气层中核试验

有关的许多问题的严重性。[48]中国声称，在早期的试验过程中，由于放射性物质的辐射影响和安全措施不当，使基地的一些科学家和技术人员遭受了放射性沉降物的危害。在靶心区（军事禁区）进行的早期试验，给整个地区带来了一系列严重的辐射污染。因此，现在经过该地区车辆的门要关严并以高速通过。[49]据说聂荣臻对辐射给基地人员带来的危害十分焦虑，他于1967年1月在新疆对安全情况进行了一次视察，发现在罗布泊基地工作的许多科学家和技术人员暴露在大剂量的核放射性物质中，年轻人都过早地秃顶。[50]

但在15日那一天，当爆炸时刻即将到来之时，靶心区的工作人员没有一个人对这些危害产生过哪怕是一瞬间的担忧。曹技师很平静地监视着圆桶状容器（高约2米，直径约1.5米）里的弹体从地下车间移到地面，然后由他的助手把炸弹放到手推车上，由两名技术人员把它送往铁塔。几天以前，周恩来总理就同基地的领导通了话，听取了他们的汇报，并且“询问了一些其它人容易忽视的每一个细节”[51]。据说，在两名技术员把车推到塔梯前，想起了周总理的嘱咐。

此外，还有两位专家密切监视着路上每一时刻可能发生的情况，记录着炸弹运到塔架过程中的情况。李觉、吴际霖、王淦昌和朱光亚站在一旁默默地观看着运送过程。铁塔和弹体周围的工作人员听到他们的指挥员陈能宽发出了命令：“升起！”八一电影制片厂的摄影机也随即转动起来。[52]

试验塔高120米，塔顶上的技术人员接到炸弹后就开始将它安装在铁塔上，几个小时后，他们检查了塔上所有仪器显示的数据，然后把爆炸装置的顶盖盖好。这些天来，李觉、朱光亚和他们的助手们一直是争分夺秒地工作。现在，李觉、张蕴钰和两位工程师最后一次来到塔上，安装了电引线，做了最后一次检查。当他们在离爆炸零时前50分钟回到地面时，周围的人们关心地询问他们为什么比预定的时间晚下来4～5分钟。李觉答道：“我一定要亲自确认没有

任何的差错”[53]。

接着，这些人就撤离到离试验塔 23 公里的试验控制室内。李觉把塔的电控装置的钥匙交给了控制室的领导。采取这一安全措施是为了保证原子弹不能被爆炸塔附近的任何人引爆。这也是引爆前最后时刻的一个检查环节。这时，15 点前的秒数显示开始：10，9……，在准确的时刻，指挥员发出了命令：“起爆！”[54]

随着起爆的命令，现场的指挥员还发出了几道别的命令。[55]在试验区上空，一架专用飞机直接从正在上升的云雾中穿过；另一架由一名妇女驾驶的飞机开始进行一次 36 小时的飞行，以便收集将来进行放射性沉降物分析用的空气样品。[56] 70 公里外，负责观察和指挥的工程技术人员们通过有防护的玻璃观察到爆炸和产生的烟云的情况。炮兵部队发射了火箭用来从蘑菇云中收集样品。另一些人准备完成一项危险的任务。他们穿上防化服，驾车进入试验区，收集同核辐射有关的数据以及冲击波造成的影响。特种装备的部队直接冲进试验地区来检验他们的车辆在核爆炸条件下的作战能力。[57]李觉和吴际霖始终一言不发。王淦昌、彭桓武、郭永怀、朱光亚和陈能宽等人为经过多年试验终于成功而激动得不能自控，都默默地哭了。

整个指挥所里的人们都欣喜若狂。[58]张爱萍、刘西尧和张蕴钰都激动得浑身颤动。张爱萍要求人们科学地证实发生在眼前的奇观。“这是一次核爆炸吗？”王淦昌肯定地回答：“是的。”然后，张爱萍给北京的二机部挂了电话，下面是通话的记录：

“我是张爱萍，请刘杰同志（部长）。”

在二机部原子弹试验办公室里，……刘杰正和几名高级干部焦急地等待着，……电话铃响了，一名干部（接电话的同志）太紧张了，以至把话筒掉到了桌上，刘杰一把捡起来，“请报告周总理和毛主席，我们的第一颗原子弹爆炸了！”

“再说一遍。”

“原子弹爆炸了，已经看到了蘑菇云！”

“我马上报告！”接着，刘杰抓起了专用电话，“我是刘杰，请周总理讲话！”

“我是周恩来！”

“总理，张爱萍同志从试验基地打来了电话，原子弹已经爆炸了，看到了蘑菇云！”

“好，我马上报告毛主席。”

几分钟后，周总理给刘杰回了电话：“毛主席指示我们，一定要搞清楚是不是核爆炸，要让外国人相信！”刘杰立刻把毛主席的指示传达给张爱萍。张回答说，这确实是一次核爆炸，这一点已经被充分证明了。这时，刘杰不由自主地开始抖动，但他又给周总理打了电话：“我们的第一颗原子弹已经爆炸成功。”他告诉周说：“这是一次成功的核试验！请党中央和毛主席放心。”这以后的几分钟里，刘杰一直激动得说不出话来，他在第九研究院时就开始规划，历经千辛万苦，现在爆炸终于成功了，这副担子也终于放下了。

这天下午，欢乐情绪笼罩着北京城。[59]几千名男女文艺工作者聚集在人民大会堂的宴会厅，在进行了一场“东方红”大型歌舞表演后，等待着国家领导人的亲切接见。下午 4 点钟，周恩来总理接见了大家。总理做手势请大家安静，然后宣布：“同志们，毛主席让我告诉大家一个好消息，我国的第一颗原子弹已经爆炸成功了！”起初人群依然沉默着，甚至有些发愣。接着，欢呼声响遍整个大会堂。周总理风趣地说：“大家可以尽情地欢庆，但可要小心别把地板蹦塌了！”几小时后，北京的广播电台向世界播送了这一消息。[60]

第八章　战略思想和氢弹

毛泽东似乎从来没有接受核武器已经改变了基本的军事和政治现实或削弱了他的战争观这一看法。他认为他关于国际安全和战争问题的理论都是永远适用的、放之四海而皆准的，即使他的哲学思想被迫发生变化而不得不重新思考时也是如此。阿尔伯特·爱因斯坦曾说，核武器能改变一切。这话不容我们思考，对毛泽东是不适用的。[1]这位中国领导人丝毫不容许人们以核现实的名义改变他的人民战争和大战略的思想。

在战争问题上，他像斯大林那样采取同样的教条主义观点。正像政治科学家赫伯特·迪纳斯坦指出的那样“斯大林的教条只不过为战争的讨论提供了一般准则。作为讨论的基础，其用途的真正标准是解决核武器存在提出的问题的能力。在斯大林的永远起作用因素的原则里缺乏这种能力，他的作战原则拒绝讨论真实问题”[2]。当然，毛泽东不接受“永远起作用的因素”的思想，因为他坚持过去的革命原则。

然而，毛主席既已批准了核武器计划，就要坚决支持和保护这项计划。因此，得到支持的核计划进展迅速，到1963年，第一次原子弹试验日期的预定变得更加可靠。行动计划不得不立即提前研究部署要求，公开宣布的原则和军事实践开始脱节。

下面我们研究一下导致1964年10月的试验和后来实施氢弹和弹道导弹计划的几个月时间内中国核武器政策受到的压力。在核武器研究计划继续进行的时候，毛泽东的一些有关政策被搞混了。在

与苏联的激烈论战中和 1966 年后在“文化大革命”的高潮中得到证实。在刚组建的战略火箭部队——第二炮兵的计划和作战中心内部，军事指挥员开始探讨在何处和如何部署新型武器，以谁作假想敌人，以及由谁下达发射命令等指导原则。为了作出上述决策，他们光靠毛泽东那本“小红书”的革命格言是远远不够的。

1963 年至 1964 年中国的核政策

1963 年新年伊始，北京经过反复研究与莫斯科扩大了原则争论。[3]自然，关于中国就战略和战争问题展开的讨论，只能坚持毛泽东的核心思想。不过在自己造出原子弹前的一年里，北京对众所周知的题目增添了有意义的内容。增加的这些内容与向第一次核爆炸的最后冲刺是一致的。

1 月，中央委员会机关刊物《红旗》杂志又一次乞灵于列宁的名字批驳苏联的“现代修正主义”和莫斯科对毛泽东关于帝国主义和原子武器的论点所持的反革命对立态度。它给苏联的原则贴上了“安慰奴隶的靡靡之音”的标签。[4]后来在 3 月，《红旗》发表了一篇长文，只不过是对人们熟悉的毛主义分子关于核战争和战略的立场所坚持的东西的炒冷饭而已。[5]该文长篇大论地引证了毛主席关于帝国主义正处于政治和经济上的衰退时期的论述，而后使这一预言适应在战略上藐视敌人、在战术上重视敌人的毛泽东路线。出自激烈斗争的迫切需要，《红旗》作为对策略估计的反映指出：“帝国主义者和一切反动派都不会自动退出历史舞台”[6]。在危机即将到来时，中国的敌人可能起来反抗，也可能冒险使用核武器。那时，中国可能预见到了印度支那即将发生战斗。

《红旗》就战略与战术评论问题发表的首篇文章是“战争与和平综述”。该评论历史部分的主题是战争来自于帝国主义国家的侵略本性及其内部的固有矛盾，而不是来自人民的反抗或社会主义国家的政策。这一事实表明，把任何单方面或过早的裁军看作通向和平的

道路，显然是愚蠢可笑的。尽管苏联某些人认为革命斗争会引起全球大战，但是唯有这种斗争而非裁军才是防止这种战争的可靠手段。另外，原子武器并没有改变“社会发展规律”或使马克思主义、列宁主义过时。的确，帝国主义者挥舞原子武器只能暴露“其罪恶阴谋”和其明显的恐惧心理，只能使其在国际社会中处于更加孤立的地位。正像毛在过去论证过的，如果帝国主义者使用了这种武器，则它就能够摧毁他们想征服的财富和人民。最后，《红旗》的文章宣称：“核武器的秘密早已不能垄断。”在社会主义者的手里，核武器才能用于“纯防御的目的”，因而，“社会主义国家有了核优势”也不会有战争的危险。[7]

3个月之后，中国报刊关于“国际共产主义运动总路线”重大论战的第一篇文章中对这些口头禅作了引申。[8]这一文献重申了如下的论点：裁军建议收到了揭露帝国主义者的阴谋诡计和激励人民与其进行政治斗争的双重效果。但是，裁军只有经过“共同斗争”之后才能达到。在这种斗争中，只有要求“完全禁止和彻底销毁核武器”才是合适的；只有社会主义国家和帝国主义国家间的军备谈判坚持这一最终目的，中国才支持军备谈判。

如上所述，在1963年的这些声明中，表达的思想大多数重复了毛主义者50年代或以前的基本观点，但是北京的坚定不变的立场，在美国、英国和苏联于8月5日签订的部分禁止核试验条约面前似乎也发生了一些变化。[9]就此条约，中国宣称，苏联领导人玩弄了两面派手法。他们与帝国主义者勾结起来，“巩固自己的核垄断地位，而把一切受威胁的爱好和平的国家的手脚束缚起来”。部分禁止核试验条约以缓靖手段即“假和平”对付“真和平”的要求。[10]

与本研究有关的是三方条约对北京关于对它的敌人看法的影响以及根据北京的核武器计划，对它的战略观点的影响。在这方面，政治局认为，该条约的“中心目的”是使“一切受威胁的爱好和平的国家包括中国在内，不能增强自己的防御力量”[11]。中国领导人认为，

“任何一个社会主义国家都必须首先依靠本国的国防力量”，而不是依靠莫斯科维持其生存。[12]对除了苏联以外的社会主义国家来说，有了核武器才能够促进和平：“我们的实力越强越好”[13]。

根据中国的观点，苏联签署的部分禁止核试验条约预示着相反的结果，即抛弃所有社会主义国家协调一致的战略原则。自此以后，苏共中央主席团成员就被看成是“但求保全自己，不管他人死活”的变节领导人。在赞颂与“苏联人民”的传统联系的同时，中国指责“苏联领导人”与华盛顿勾结，“阴谋束缚中国”，一再重复1962年9月以来致莫斯科的备忘录的主题：“问题在于，不管苏联政府是否承担了不向中国转让核武器及其有关制造技术情报的义务，但是……中国政府希望苏联政府不要侵犯中国的主权，代替中国承担不制造核武器的义务。”根据中国的观点，禁止核试验条约是苏美企图对中国“施加压力，使中国承担义务”的共同阴谋。[14]在进行核试验的前一年，北京只能把这种行动看作是敌人对中国施加影响以制止其核计划的一种手段。

后来中国驳斥苏联对其谴责时，中国回答了莫斯科提出的问题，即“即使中国领导人坐在他们自己的原子弹上，他们是否觉得更安全”[15]。北京回答说，答案显然是肯定的。自然，新建的核武库会使美国“把更多的原子弹瞄准中国”，因而人民共和国会对这种令人不快的可能性保持警惕。但是自从美国用核武器瞄准中国之后，这种危险并没有“增加多少”。相反，中国的核力量能使国家更加安全。[16]

中共政治局利用这一回答的机会，进一步阐明了社会主义国家在核威胁面前应采取什么样的适当行动。它认为，在1962年苏美古巴导弹危机中，莫斯科由于犯了“冒险主义和投降主义的错误”而背弃了原则上可以接受的政策。社会主义正确的政策首先应该避免与美国正面冲突的危险。但是，既已承诺在古巴部署导弹，苏联就不应该在华盛顿的“侮辱人的言词”面前投降并从古巴撤出导弹。这

一退却只能助长“帝国主义者的侵略性和嚣张气焰”。苏联犯了一个颠倒正确战略和战术路线准则的错误：“如果在战术上不能充分估计敌人，对其采取漫不经心、满不在乎的态度，而在战略上又不敢藐视敌人，不可避免地会犯战术上的冒险主义错误和战略上的投降主义错误。”任何一项原则政策必须使实际的谨慎态度和合理的解决方法结合起来。[17]

在写这篇评论的时候，距 596 炸弹爆炸还有一年多的时间；铀的浓缩和原子弹设计的最后阶段的工作正在兰州和青海进行。在评论发表后的几周之内，外交部长陈毅向日本记者团说：“原子弹、导弹和超音速飞机是一个国家工业技术水平的反映，中国必须在今后几年内解决这一问题，否则，它将变为第二流或第三流国家”[18]。这一声明显然是对苏联的进一步谴责，正像战略专家艾丽斯·兰利·西指出的那样，“中国人想研制自己的核武器是为了追求不能靠社会主义阵营军事力量支持的特殊目的和利益”[19]。

1963 年 11 月 19 日，中国阐明了正是这种理由即对莫斯科来说比陈毅说的可怕得多。[20]重申支持不首先使用核武器的一贯政策，并反对在革命的国家内部署核武器的立场，中国希望社会主义国家“取得和保持核优势”。但是，哪些国家称得上社会主义国家？不是苏联。中国人暗示：“苏联共产党的领导人已把他们的斗争矛头指向了社会主义阵营……他们用核讹诈来吓唬社会主义国家的人民……他们用核讹诈来吓唬被压迫人民和被压迫民族”。中国即将表明，他们自己的核武库可以保卫自己的国家，对抗苏联的威胁。

在以后的几个月内，在 1963 年末和 1964 年初，中国军事报刊转向其他问题——重点从“人是主要因素”转到强调毛泽东著作学习和“军队的政治思想工作”[21]，中苏辩论只是重弹战争与和平问题的老调。还有些迹象表明，出现了教条主义的评论。例如，1964 年 4 月，中国公布了一篇少有的关于西方防御思想的文章，分析了美国的灵活反应战略。作者红凡提（音译）回顾了约翰·F·肯尼迪总统

的看法：美国没有解决对付“有诱饵的能以最大速度袭击我们的整个导弹核武库”的问题。红凡提指出，与艾森豪威尔的新看法有关的大规模报复战略已经让位给以“情愿自杀”为基础的战略。他强调指出，美国已被迫放弃了艾森豪威尔的战略，因为苏联的核武库日益增强，表明社会主义者手里的核武器能够产生积极效果的变化，而且表明“敌人”实际上不是核武器，而是“美国帝国主义”[22]。

几个月之后，中国利用第十届禁止原子弹氢弹世界大会上的机会强调最后这一点。因为当时中国正在准备自己的核武器，毛泽东的政治局企图使国际和平运动偏离反对原子弹本身的轨道，并指向谴责“美帝国主义这个世界和平的最凶残的敌人。”在对大会的致词中，中国代表团团长刘宁一嘲弄了苏联的倒退路线，因为它把“核战争的根源看作是核武器而不是以美国为首的帝国主义。”刘宁一再次揭露了部分禁止核试验条约，指出它是一个“有利于核大国实行核垄断、核讹诈，有利于美帝国主义”的协定。他反复断言，苏联用此条约“反对社会主义中国”。而某些“从善良的愿望出发”的人可能认为“有了部分禁止（核武器）总比不禁止好”，这些人简直是苏联阴谋的牺牲品。[23]

刘宁一的发言是1964年10月16日原子弹爆炸之前中国关于核武器问题的最后一次重要声明。以前几次声明中的大多数要点在60年代其余各年反复陈述。但是，这些要点与中国军事最关心问题的关系越来越小，因为国家已分裂并开始陷入“无产阶级文化大革命”前的最初辩论中。[24]

与其说为了推动领导去探索以核武器（现已成为中国武库的一部分）的作用为基础的另一种思想，倒不如说10月的原子弹试验主要是用来加强中国成功的国际路线。新的战略思想的探索终止了。北京公开发表的有关核武器的文章是为重要的辩论和策略目的服务的，不过打着根本安全问题的幌子。对最高级领导人来说，核武器很快就成为了无关紧要的问题，因为争夺权力的严重斗争已经开始。

研制氢弹

第一颗原子弹装配的成功标志着戏剧高潮的到来，但这并不意味着二机部工作量的减轻。首先，酒泉原子能联合企业需要准备裂变武器的系列生产并完成钚设备的安装，而且铀计划不得不从矿山推向兰州，而后才谈得上氢弹问题。

从一种型号武器的研制到下一种型号的过渡的依据可追溯到1959年，中国已“跻身于”后起的核国家“之列”。当时，按照刘西尧副部长的说法，北京的中央领导已开始“拟定一项重要计划并及时集中了我们的人力和物力资源，来发展必需的新材料、设备和仪器，因为这些牵涉保密问题，我们不可能从外国得到”。这一计划既包括原子弹，又包括氢弹。到第二年，九院的北京核武器研究所一直在全神贯注地研究原子弹，同时，二机部指示原子能研究所组成一个研究热核材料和热核反应的“领导小组”。由钱三强、黄祖洽、子敏和其他人组成的这个小组，开始“不断积累与热核聚变过程有关的一些基本参数”[25]。了解这些参数的过程，刘西尧说，“逐渐地给我们有关基本规律的指挥权”。

九院的原子弹设计小组于1963年9月结束了596号武器的长期研究工作之后，聂荣臻立即下令，让其成员原封不动地转移到热核装置的制造上去。[26]在青海，理论部（由邓稼先领导）承担了设计中国第一颗热核武器的重要任务，因为当时理论部处于原子弹设计的最后阶段。然而，我们对这项研究工作的细节知道得很少，据中国报道，北京决定沿着多种途径着手聚变装置的研究，大大地缩短了裂变武器与聚变武器之间的时间间隔。[27]

不管进行哪种氢弹的研究，都有一个根本选择问题。大概说来，问题集中在武器的尺寸上。投到广岛上的原子弹的爆炸威力大约相当于12500吨（12.50千吨）梯恩梯，中国1964年10月16日进行的第一次原子试验的威力与此威力相当。聂荣臻的设计人员可能对

其下一代武器的当量为投到日本原子弹的 10 倍和他们自己的第一颗原子弹而感到满足。但是，中华人民共和国的战略家们知道，部署在计划建造的导弹上的百万吨当量弹头可以部分弥补精度较差的投掷系统。这种计算很简单。更重要的是，他们相信百万吨核武库能够增加中国军事实力的总的可靠性。尽管他们认识到，要发展这种核武库必须发挥很大的创造力，也可能失败。

百万吨核武器的实际价值在于，更大的爆炸声可以对中国敌人的理智直至决策产生无法比拟的影响。这种武器对防止核突击可能具有决定性战略意义。北京的外交政策专家和军事计划人员懂得，技术的获得，例如制造大当量弹头或掌握导弹工程，可能把重要的政治信息传递给华盛顿和莫斯科立足最坏情况的计划人员。总之，这种信息能够起到宣布新战略思想的作用，能够代替人民战争和纸老虎的作用。

开始时，中国决策人员必须就制造哪种类型的氢武器取得一致意见。为了评价他们面临的选择，我们必须粗略地讨论一下有关的技术内容。在热核武器内，聚变过程利用裂变爆炸所产生的极高温度。这种极高温度又造成了类似于太阳中心的条件，在这种条件下，氢或其同位素之一氘（^{2}H）和氚（^{3}H）聚变成氦。“人们已观察到这 3 种氢同位素核间，包括两个类似的核或两个不同的核间的几种不同的聚变反应”[28]。当在这种热核反应过程中形成氦核时，能量就以快中子、高速光核子和其他形式释放出来。

聚变武器有两大类型：聚变加强型裂变武器和多级热核武器。[29]在第一种类型中，氢弹的制造人员把聚变材料放到内爆式裂变武器的弹芯内。聚变材料用封装在高能炸药内的裂变铀或钚包围起来。“当（弹芯）受到化爆的压缩时，不可控制的链式反应便开始了。（由于温度迅速升高），装置内部的聚变材料……被点燃。”形成的聚变反应释放出大量的快中子，使裂变链式反应加速；这一“复合过程”中引起的更高温度创造了一个效率更高的裂变炸弹，其爆炸威

力可达几十万吨。

在实际的热核弹内，武器内的裂变装置起着点火器或引爆器的作用。引爆器的爆轰在弹壳内产生很高的温度、弹壳原来起个瓶子的作用，用来保持受压的能量。“因为壳体是整体件，所以它在很大膨胀力的作用下，在第二系统（聚变材料）受到压力的作用之前，也不会破碎。”高温和高压使聚变材料燃烧，释放出大量的能量和快中子。“如果这个炸弹壳体由天然铀制成，则聚变中子将使铀核发生裂变。”这种装置有时叫作裂变-聚变-裂变三相弹。从理论上说，其威力没有上限（虽然工程可行性有一定限制）。50 年代初，美国和苏联武器专家演示了这种多级弹的设计原理。作为理论，这种原理中国专家小组也了解。

1964 年 5 月，毛泽东要求这些专家加速执行氢弹计划。刘西尧指出，对他们来讲，首要的问题是，满足于加强型武器还是决心继续研制正式的多级武器。1964 年 7 月，二机部接到周恩来总理的指示，要求核武器与导弹相结合。官员们把周总理的指示看作是生产多级导弹的弹头。刘西尧解释说，中国之所以选择高水平的多级热核武器的发展道路，是因为美国造成了高水平的威胁。“自从我们（以获取聚变武器的方式）战胜了核讹诈以来，我们认为，我们必须研制具有威慑力量的氢弹。事实证明，我们作出的决策是正确的”。刘西尧补充说：“作为高水平的目标，我们必须能够生产出可装在我们的中远程和远程导弹上的热核弹头。”

大概得到了 15 人专门委员会赞同的 7 月指令，显然是聂荣臻给九院下达指令的依据。3 个月之后，在罗布泊试验基地第一次核爆炸后几小时内，周恩来强调了这一指令并发出另一个补充命令：“只要你们以毛主席的《实践论》和《矛盾论》两篇文章和大庆油田的经验为武器，依靠由干部、专家和工人组成的领导机构，在发展氢弹的计划中就可能很快地有所突破。”为此在九院，周总理的命令激励了第一次核试验的高度热情，并促进了这一势头的继续发展。

制造热核武器比裂变武器容易得多的一个原因是包括基础科学和技术专家在内的参谋部已经组成，并且经受了制造核武器的考验。按照刘西尧的说法，“我们决定开始研制我们的氢弹计划时，形势对我们很有利。”其中，理论设计和工程设计间的关系相当密切，而且中间试验的要求少得多。然而，刘西尧又说：“我们知道，为实现热核聚变应当使用哪几种材料。我们也可以使用美国、苏联和英国制造氢弹所采用的必要基础材料。”一些关键材料，包括裂变装置本身的材料，已在生产中。而且，到这时，中国已有了性能先进的计算系统：“我们有计算器和原始的计算机，足以完成热核反应的计算任务，并满足其理论设计的需要”[30]。早在60年代初期，中国的理论科学家就开始了“关键参数”的研究工作，北京官员中的大多数人信任他们的科学家。刘西尧宣称：“我们有许多核科学家，他们与外国的核科学家相比毫不逊色。外国人能干的，我们也能干。”

然而，并不是一切都依靠自力更生，正像刘西尧说的那样，“没有苏联的工业援助，……我们就不可能在原子弹和氢弹的制造中取得如此迅速的成功。”刘西尧说，中国不可能得到“有关氢弹研制的秘密科技资料”。但他没有透露细节，只透露他们从分析国外公布的有关报告得到了好处。这些报告“对我们统一思想、确定目标作出了特殊的贡献”。

中国通过阅读外国文献学到的东西使他们了解了热核反应所需要的材料，并且在1964年至1965年冬季，他们建成了一种主要热核材料——氘化锂-6的生产线。①他们“对这些材料的性能却什么也不了解……或对氢弹在什么具体条件下才能爆炸也不了解”。但是，

① 氘化锂-6是一种化合物。当武器内发生聚变反应期间，用中子轰击锂-6产生氚。1959年，二机部开始在内蒙古自治区的包头核燃料元件厂（202厂）修建氘化锂-6车间，以便分离同位素，生产氘，进而合成化合物。苏联撤消援助后，使中国无法得到该车间建设所需的一些关键设备和科学资料，中国人的应急措施是把一些科学家由原子能研究所调到202厂新建的锂同位素研究室。化学工业部为分离氘提供重水，冶金工业部则提供含锂的矿石。第一批锂-6是在1964年9月17日分离出来的，一周以后，该车间便生产出第一批氘化锂-6。在这几年中，中国人还在自行设计的工厂内研究氘的生产问题。该厂于1968年5月全部投产。

他们学会了如何用原子弹来创造这些条件，并且他们的任务很复杂，因为在裂变引爆器内必须用浓缩铀而不用钚。这些基本问题使九院包括来自北京核武器研究所和原子能研究所的专家在内的设计小组全神贯注地加以研究。

1965 年 2 月，二机部指示原子能研究所对氘化锂的分子进行测量并分析其反应。钱三强指派 50 名高级科学家和工程师执行此任务，并调配 4 部加速器和其他稀有设备供他们使用。他委派女科学家何泽慧负责协调这一伤脑筋的研究课题。

设计小组在氢弹上的主要工作花费了 14 个月的时间。首先，青海九院和其他单位的研究计算和实验集中在氢弹引爆器的可能设计方案上，以此作为理解整个爆轰过程的第一步。科学家们在邓稼先的领导下夜以继日地工作着、到 1965 年底，提出了最有希望的方案的理论基础，当时中国已发现了“有关热核材料燃烧的内在原因和外部要求的一些关键问题”。

这一发现依赖于成功地进行大量的计算，要求使用中国的最好的计算设备。1965 年 9 月底的某日，九院派理论部副主任于敏去上海进行这些计算。大约过了两个月时间，他给青海发电报说，他已“发现了”通向超级武器的“捷径”[31]。这份令人充满信心的报告催促邓稼先去上海找于敏，在那儿，他肯定了于敏的发现。而后，这两人与部里领导一起讨论了他们的结果，并说服刘西尧副部长（他当时是常务副部长）给“冷试验”① 连队下达命令。正是这些试验（可能是在 1966 年初进行的）证明了“热核材料燃烧……的关键问题”，并促成了第一次聚变加强型裂变武器的爆炸试验。

1966 年 5 月 9 日，轰-6 中程轰炸机空投含有锂-6 的 20～30 万吨 TNT 爆炸当量的铀装置进行的试验，证明“加强型装置”是可行的。这次试验主要是解决热核材料的性能问题，而后在 1966 年 12 月

① 中国常用“冷试验”这一术语，其含义是不含裂变材料核装置的物理试验。

28 日进行的试验，检验了“热核爆炸的基本原理”，使用的是 30～50 万吨当量的铀-锂装置。这两次爆炸证明了邓-于“理论方案”是正确的。因试验成功，所以 15 人专门委员会决定直接进行多级热核弹的试验，终于在 1967 年 6 月 17 日进行了 300 万吨当量的热核装置试验。

当理论和实验工作在九院和试验基地继续进行的时候，党内的激进派发动了“文化大革命”，挑起了一系列的破坏性政治运动。[32] 1962 年底开始的全国一致支持战略计划的时期已经结束。1965 年至 1966 年冬，北京的政治军事领导开始分裂。第二年春季，极左派势力开始猖狂活动。4 月，军队宣布“文化大革命”开始。[33]而后 10 年发生了持续不断的动乱，这一主要事件本身不断地削弱战略武器计划的基础，尽管开始时毛泽东倾向于保护这一计划。[34]

氢弹计划没能逃脱“文化大革命”的影响。当 1966 年夏群众运动的暴力迅速蔓延开来的时候，九院看来再也不是世外桃园了：“风云突变，霎时间中国一片骚乱。若干著名科学家不得不停止其研究工作。（在北京的家里）邓稼先的夫人被当众声讨，不久他的儿子和女儿被迫迁到农村”[35]。邓稼先断定，个人努力无助于事件的逆转，对青海日益增长的骚乱作出相应的规定和发出行政命令也阻止不了群众大批判的潮流。因此，他想通过组织和拥护群众热情的办法，把它用于支持热核武器计划。当时的一份报告指出，理论设计单位提出了一个口号：“提前进行氢弹试验，向无产阶级文化大革命献礼！”据报道，政治运动鼓舞设计单位的人员加班加点地工作，结果他们提前一个月完成了设计。[36]

另一个策略是开展爱国主义教育与法国人竞赛。那时，法国人在加速执行其氢弹研制计划。通过对这一情报的研究，中国科学家……建议“我们必须赶在法国人之前爆炸我们自己的第一颗氢弹”。邓稼先支持这项建议，并得到部里的批准。科学家的话被当作口号来鼓舞所有参加竞赛的人的士气。这一口号就像一面指示方向的旗

帜，传遍整个九院，因而敌对情绪和人员间的冲突暂时缓和下来。“卷入派性的科学家和技术人员开始讨论为达到最终解决氢弹理论设计的所有可能的途径。”这时，合作精神又回到了理论部。

文化大革命和氢弹试验

这种精神不可能长时间不受“文化大革命”的影响。在国内广大地区，事态的发展在加剧。到1966年中，群众运动完全与核武器试验平起平坐了。好像是在人的狂暴和被释放的原子之间已达成了一项奇怪的协议。

例如，当打着造反旗帜的红卫兵组织1966年在北京迅速发展起来的时候，酒泉附近双城子的第二炮兵部队的士兵向新疆以西800公里处的地面零点发射了带有原子弹头的“东风”2号导弹。当播出10月27日进行的这一试验的消息后，受到鼓舞的青年人涌入北京街头，载歌载舞。他们唱着毛泽东思想的颂歌，高举着标语牌，欢呼毛泽东激进主义的创造力和氢弹威力相结合的胜利。写有“喜喜”字和声讨美帝国主义罪行标语口号的数以万计的小旗，布满了街头巷尾。[37]

聂荣臻充分认识到10月27日试验要冒异乎寻常的风险，他在试验前两天坐飞机来到双城子亲自负责指挥。[38]聂荣臻懂得：“万一核导弹在现场爆炸，或发射后掉下来，或偏离弹着区，都会造成不堪设想的后果。”他命令导弹部队指挥员向他简要地汇报有关安全程序的详细情况。发射后，他立即飞往新疆基地的弹着区评估导弹的精度。聂荣臻确认“东风”2号导弹“非常精确”。

返回北京后，聂荣臻的国防科学技术委员会所有工作人员集中起来学习毛主席著作，并宣称“导弹核武器试验是一项伟大的创举，是精神原子弹的威力导致了物质原子弹的爆炸”。党的领导人告诫聂荣臻领导的武器研制人员“到艰苦的地方去锻炼改造自己”。即使他们在“住帐篷、喝咸水、头顶烈日、脚踏风沙的条件下工作，又有

什么了不起？”只有这样做，他们才算响应了毛主席向科技人员发出的号召，“投身到斗争和实践……滚一身泥巴，他们才能具有工农兵的思想感情……他们算出的每个数据，在设计图上画出的每条线才能充满对全中国人民和全世界人民负责的精神”。艰苦的磨炼，确保他们在面对可能背叛或玷污毛主席的考验时刻成为坚定的忠诚分子。[39]

1967年1月，聂荣臻联合激进分子以避开激进分子渗入战略计划的战略开始破产。相互争斗的几派已开始瓦解二机部钢铁一般的秩序，而后组织体系突然崩溃。三个主要派别组织纠合起自己的战士相互开战。最大的派别组织革命造反总司令部（革命造反总部）把攻击矛头指向部的领导和机关人员，后者自己组成了红旗总司令部（红旗总部）。而最小的派别组织拔毒钉总司令部（拔毒钉总部）伺机活动，等待时机以挑起更大的冲突。战斗结束后，革命造反总部获胜。[40]

随着北京部里的纪律瓦解，核武器试验基地的工作人员不顾当时的命令，邀请哈尔滨军事工程学院的红色造反兵团（红色造反团）去新疆“串联”。国防科学技术委员会曾指示该学院为战略武器计划培训人才，因此试验基地人员中有许多哈军工的毕业生，他们与母校保持着密切的联系。毛泽东鼓励其在哈尔滨军事工程学院的应届毕业生毛远新攻击更高当局，因而他及其学院的狂热帮伙经过4000公里的旅途来到罗布泊基地。他们到达前一周，聂荣臻已来到基地。他对即将来临的“革命行动”（红卫兵串联时常这样叫喊）马上作出反应，称之为暴行。[41]

聂荣臻立即命令新疆军区司令部保卫基地的安全，作为一项紧急措施，与当时的保密条例完全一致。[42]当哈尔滨的来访者冲击试验场地时，基地的警卫部队逮捕了他们，于是对抗加剧，对立的组织又开始动员其派别分子。为了火上加油，一个年轻造反者向北京打电话，接到中央文革小组组长陈伯达那里。陈伯达立即给聂荣臻挂

电话。高高在上的陈伯达要通了基地指挥中心的聂荣臻的电话，于是一场紧张的对话开始了。陈："谁下的令（拘留造反者）？"聂："是我。"在争辩中，聂荣臻提醒陈伯达是中央军事委员会责成他聂某人对试验计划的成功负责。然后突然挂断电话。

逮捕和对抗这两招暂时使局势得到控制，不过聂荣臻已明显地意识到其地位的危险。他命令1967年1月10日上午的试验如期进行。不久返回北京参加1月19日中央委员会的一次极其重要的会议。在这次会议上，军事统帅部、中央委员会和国务院联合决定："部队必须立即对所有的重要仓库、监狱以及符合中央委员会规定的其他重要单位实行军管。"[43]所说的"其他重要单位"包括战略武器基地。经过这样重申之后，这种高科学和原始政治的不稳固联合一直持续到1967年的春天，尽管有大的干扰。[44]

5月初，酒泉联合企业的核部件制造厂完成了氢弹的装配，5月9日15人专门委员会指示罗布泊基地到6月20日结束试验的准备工作。尔后，聂荣臻领导的委员会命令基地用不带核部件的原型弹进行试验。[45]

尽管核计划一时没有受到破坏，但是，反复无常的形势、政治阴谋及专业人员漫不经心的态度，破坏了定于6月17日进行第一次多级热核装置试验的准备工作。在罗布泊核武器试验基地，一些工人和职员卷入了"文化大革命"的四大："大鸣、大放、大辩论、大字报"。进而，他们转向"夺权"，参与战略武器计划的工人们不顾官方的禁令，使试验准备工作受阻。[46]因为政治是"统帅"。

试验前几天，王淦昌从九院来到基地一个车间主任的郊外住房内，他命令工作人员返回工作岗位。主任回答说："命令的方法（在基地）已不起作用了，因为车间的领导权已被夺走。"他指出，各种困难甚至影响到装配和供给问题，并告诉王淦昌，已没钱办伙食了。王淦昌沮丧地掏自己的腰包给炊事员发工资，尔后去车场组织卡车司机把设备和氢弹运到试验场。

大约在这同时，周总理从国家简报上了解到，用降落伞投弹演练时，降落伞撕裂了3个口子。[47]空军从4月起就已进行了模型弹的空投训练。他命令增定新的安全程序，包括引爆控制系统的追加试验，并派聂荣臻到现场监督6月17日的试验。

在这一天，试验场的技术人员在聂荣臻的亲自领导下，挂上毛主席巨幅画像，两侧各树一簇红旗和毛主席语录牌。[48]在进行试验准备的过程中，核试验基地的青年工人们大胆地打破官方程序，他们甚至在九院完成武器设计任务之前，早已开始了他们自己的工作。[49]显然，基地工人们已制造出他们自己的监控设备，而不是从工厂得到的，为的是证明他们相信毛主席的自力更生原则。试验控制中心的技术人员“一边声讨、批判党内最大的走资本主义道路当权派的滔天罪行，一边继续设计、试验和试制”。

试验前几小时，氢弹被吊装到轰-6中程轰炸机上，以便运到罗布泊试验基地上空的指定投弹点。在飞机的机舱内，西北工业大学1964届毕业生贺先觉负责对氢弹进行最后一次检查。他在仪器定装过程中进行了最后一分钟的调试，以便投弹后“能够提高爆炸精度(记时)”。[50]

但有一次，在726号轰炸机机组人员中有人神经紧张起来。他当班，驾驶员觉得正常操纵飞机有困难，因而导航员有一次飞过目标，没能在早8点零分准时投弹。推迟的密码电报迅速发往北京，周恩来亲自给机组人员发无线电报，鼓励他们“要沉着，要果断。”驾驶员徐克俭（音译）后来进行第二次飞行，氢弹于8点20分顺利投下。

爆炸造成巨大的破坏。离地面零点400米处的钢板被熔化，混凝土构件也被熔化，其表面变成玻璃体。冲击波撞到距地面零点3公里处的54吨机车上，把它推出18米远，半地下防御工事被震成碎片，14公里远处的砖房倒塌。壮观的火球迅即变成雄伟的蘑菇云。

在试验场地上，政治是统帅。军报赞扬技术能力和政治热情的

结合保证了在“氢弹爆炸一瞬间”控制中心的设备完美无缺的工作着。据报道，这套设备的操纵人员是刚刚“走出校门的新手”，他们的思想方向体现了参试人员的英雄气概和这一事件的重大政治意义。[51]

投弹命令发出后片刻，来自基地警卫部队的士兵跳出防护壕，高呼：“毛主席万岁！”“火光是命令，爆炸是冲锋信号，烟云（蘑菇云）是目标”。他们冲向爆心。这一切标志着中华民族向新的高峰迈进。中国的氢弹“震撼了全世界”。中国人民显示了他们“赶上并超过所有国家的力量和能力”。

从试验装置到武器

到 1967 年 6 月轰-6 轰炸机投下热核装置时，中国的核武库计划已取得了很大进展。早在 1960 年初，中央军事委员会就命令九局开始研究如何使核计划“武器化”，研究把试验装置过渡到可投掷的核弹和弹头。[52]

几乎在同时，北京核武器研究所增加了武器研制的课题，并把它作为计划优先考虑的项目。它开始调研不同外形的气动特性，弹头的结构和引爆控制系统。二机部也作出响应，与负责飞机、电子设备、常规武器以及导弹的各部级机构取得联系，以便开始空投核武器的研究和发展工作。中国人很快得出结论，这种武器的研制将需要制造性能大大改进的数据控制设备和试验设备，因而下令开始制造这些设备。

从 1960 年 4 月开始，设计小组制作了许多气动外形不同的武器模型并开始进行了风洞试验。到 1961 年底，试验已进行到部队可以用缩比模型在炮兵试验场进行试验的地步了。全尺寸模型的试验是一年以后在空军基地开始的，同时其他单位继续进行由电源、引信、保险和点火装置组成的爆炸系统的研究工作。该系统到 1962 年底已做好飞行试验准备。

1963 年，空军指定独立第四团执行这一任务，来自罗布泊试验基地马兰的专家与该团的空勤人员一道工作，利用光学和无线电遥测设备检索数据，他们在每次试验后，立即把影响设计的数据传送给氢弹制造厂。这一阶段的研制工作在第一次原子弹试验前已完成，不过后来他们又不得不以这次试验的数据为基础，进行了修订，提高性能的可靠性。

在执行飞行试验计划期间，空军还发现需要改装其新型中程轰炸机（图-16 飞机，这种飞机先是由苏联提供的后被仿制成轰-6）。空军和罗布泊核试验基地的工程师向三机部（负责飞机生产）的飞机设计师提供必需的规范，1964 年 8 月，172 厂完成了该机的改装工作。

另外，二机部需要知道，运输和空中发射可能对弹本身产生怎样的影响。二机部下令进行遥控模拟试验，先用模型，后用真的原子弹试验。运输工具为卡车、火车和飞机。需要注意的一个关键问题是环境变化和运动对爆炸系统的影响。为了解决这个问题，中国花了 3 个月的时间研制了一种探测器。

至此，武器化计划一直按着 15 人专门委员会主任周恩来的指示进行。1963 年或 1964 年所作的这一指示指出："边试验、边定型，定型合格后再小批量生产，保证质量，装备部队，以利战备。"这时已大大落后周总理指示所要求的研制时间表。1965 年 2 月 3 日，二机部向专门委员会呈送了一份"关于加速发展核武器问题的报告"。二机部的报告直接响应了周总理关于迅速部署核武器的号召。报告建议发展每颗当量为 100 万吨重约 1 吨的热核武器。周恩来召集了一次专门委员会会议，会议采纳了报告的意见，并确定从那时起至 1967 年专门进行武器化原子试验。

1965 年春节后不久，就开始了空投原子弹的试验准备，中央军事委员会命令空军为执行此任务挑选机组人员。张爱萍全面负责指挥这次原子试验，因为他是第一颗原子弹试验的总指挥。他开始时

命令先用混凝土模拟弹而后用 TNT 炸药进行一系列训练。白垩土目标形成一个直径为 200 米的区域。一次训练中，独立第四团的驾驶员脱靶 700 米，炸掉了一座供实际试验用的桥梁。张爱萍说，我们知道了，并向机组人员说，不要灰心，要继续练习。1965 年 5 月 14 日把 3 吨重的真正物件投下时，在 500 米的高空爆炸，在靶心 40 米之内。

武器化计划下一步集中在导弹弹头上。早在 60 年代初，甚至在空投系统工作在进行时，北京核武器研究所已开始了该设计的初步调研，但直到 1963 年 8 月才开始真正的研究工作。第二年春天，15 人专门委员会指示九院加速这项研究工作，仅用了几周的时间九院就拟订出了突击计划。

导弹弹头计划大致按两条相同的设计道路——武器构形和武器引爆——进行，带有空投核弹计划的特点。4 月份，北京核武器研究所开始与青海总院一起负责武器的研制，研制的主要任务是设计弹头和对工艺、爆炸系统和环境影响进行数次试验。样品弹头的结构设计是在 1965 年初开始的。1965 年底，正当九院审查即将进行的弹头试验和氢弹研制的进展情况时，该院根据上级的批示决定把设计导弹的热核弹头作为最优先的项目。

该研究所为爆炸系统付出了极大的代价。在两年当中，所内的一些科学家一直在研究弹头的外形，同时该所另外一些人和其他单位研究了引爆器、遥测系统、自毁装置和其他安全装置的可供选择的设计方案。1965 年 6 月，在爆炸系统试验即将开始时，研究所开始了一系列的大规模试验。首次试验的是用卡车进行弹头或其部件的远距离运输。在运输过程中，科学家测量了加速度、振动、冲击、温度和湿度变化的影响。接着进行的是带无核部件弹头的导弹试验。第三次是在双城子发射一枚导弹以试验自毁系统。第四次是检验爆炸系统在飞行中的可靠性。根据周恩来的亲自命令，最后两次试验重点研究了在紧急或失败情况下系统的整体性能。

在讨论“文化大革命”时，我们已说明了武器化计划中的最新事件即1966年10月27日中国发射了一枚带有原子弹头的导弹。试验小组已于一个月前在双城子组成，聂荣臻担任现场总指挥。这是中国进行的风险最大的第一次也是最后一次试验，因而促使毛泽东宣告：“谁说我们中国人搞不成导弹核武器，现在不是搞出来了吗！”到60年代末，核武器已装备部队。

导弹与军事原则

1967年关于氢弹试验的公报赞扬了毛泽东在1958年的“光辉预见”，“搞一点原子弹、氢弹，我看有十年功夫完全可能。”尽管广播宣称“这次氢弹试验的成功，是中国核武器发展中的又一个飞跃”并且“标志着中国核武器的发展进入了一个崭新的阶段”，但是这条新闻消息强调的是这一成就应归功于中国领导人毛主席和“文化大革命”。据称这次成功大长了“全世界革命人民的志气”，并给美国和苏联的核垄断当头一棒。然而，像过去的试验公报一样，声明发展新的核武器“完全是为了防御，其最终目的是销毁核武器”[53]。

公报还强调“人是决定战争胜负的因素”，军报在当时的一篇文章中对此作了补充：“原子弹、导弹和氢弹，总而言之，不值一提”。[54]“中国第一颗自行设计、自行制造的氢弹”工作进展与60年代前半期弹道导弹投掷系统研制工作的加速进展是一致的，但是北京却利用氢弹试验的机会重申了毛泽东关于人民战争的论点。这样一来，矛盾百出：能够挫败帝国主义的武器不值一提，新阶段武器可以简单地重申旧思想；专家制造的武器可以被极端分子用来向专家发动战争。在这样两种对抗力量的牵制下，几乎没有人准备为中国澄清或阐明新原则出力。

尽管没公开讲，但出现了变化，中国没有明确说明形成早期采购和部署核武器政策的核原则。以先造多级氢弹而后完成雄心勃勃的导弹计划的决策为起点，必要的技术准备工作已开始推动军队确

定实际政策，虽然这些政策较全面具体，但其全部意义基本上仍未解释清楚。

在最后的分析中，为核弹头选择运载系统，体现了改造50年代以来盛行的以革命斗争、严密戒备和有形的军事运动为重点的军事基本原则。[55]正在形成的观点明确承认军事技术的作用和遏制核攻击的态势。人们可以说，核武器一旦部署，就会有发言权。警戒中的百万吨当量弹头，可以显示一种强有力的确保报复的新原则。

经过反复考虑，战略计划领导人把其新态势的起因归于他们在朝鲜战争时期和美国核威胁时代所得出的结论。掌管中国战略武库的人员的大多数早已认识到，正像聂荣臻所指出的“自朝鲜战争以来，经常引起我们不安的是在军事技术方面远远落后于我们的敌人”[56]。每当他们回忆以往10多年来赢得安全的艰辛历程，就会既感到骄傲，又感到有些不是滋味。他们的目标已经达到，到60年代中期，这一目标已经变成现实。根据把军事硬件和质量放在第一位的军事指导方针，战略政策是“以临战姿态搞好战备即准备大打，早打，打核战争”[57]。常备不懈的真正原则，从逻辑上说，来源于核成就。

然而，中国分析家赞扬毛泽东为新原则提出了一些基本原理。他们公开发表了毛泽东在1956年4月的一次讲话《论十大关系》。在这次讲话中，他指出了经济建设与国防建设之间的固定关系。[58]在确定核武器计划时，毛泽东限制了它的规模，指出中国的核武器“优势不在数量，即使我们能达到”；但是他又主张该计划的成功会“鼓舞我们的志气，灭他人的威风”[59]。1981年，在全面评价毛泽东的历史作用时，党中央委员会得出结论：“在建国以后，他提出必须加强国防，……和发展现代化国防技术（包括用于自卫的核武器）的重要指导思想”[60]。自然，弹道导弹计划，也是根据毛泽东的指示作出的。

1963年初，负责国防工业生产的赵尔陆，代表15人专门委员会

参观了导弹设计机构五院。在五院，他请导弹专家拟定“八年四弹”计划，即“在八年内造出四种型号导弹”的计划。按照他的设想，此计划应规定“东风”导弹系列——从“东风”2号到“东风”5号的完成期限，每一种型号根据特定的假想目标而射程不同。1964年最初拟订的计划草案中规定的假想目标和导弹型号为：日本——“东风”2号、菲律宾——“东风”3号、关岛——“东风”4号和美国大陆——“东风”5号。[61]对东风计划细节的粗略分析表明了正在出现的新技术是如何限制和影响五院导弹专家制定较广泛的战略目标和进行一般的战略设想的。

经新建七机部（1965年1月取代五院）的同意，发展火箭技术的8年计划（1965年至1972年），在原计划草案的基础上集中了约3000名导弹工人和工程师的建议。经15人专门委员会批准之后，此计划从1965年3月起生效，它提出了全面发展东风导弹和其他导弹技术的指导方针。[62]

早在1965年前指导方针已经确定，导弹研究工作已经开始。作为1957年10月谈判的结果，莫斯科于1958年1月把两枚R-2导弹（美国称之为SS-2）运往中国。[63]到1960年，中国按照R-2火箭的蓝图制成了用于研究和教学的实验性液体燃料导弹（中国称之为1059），其射程约为590公里。中国炮兵的特种部队于1960年11月进行了这种导弹的首次发射试验。五院在1960年至1963年间还试验了后继型地对地导弹（“东风”1号）的发动机，但后来暂时放弃了。

大概在1965年决策之前，导弹研究院同意对苏联的R-5导弹（美国称之为SS-3）进行改型——他们只有这种导弹的笔记和图纸——作为中国第一种作战用导弹的样弹基础。“东风”2号导弹（射程1450公里）为单级，燃料为不可贮存的酒精和液氧，发射方式为公路机动。[64]“东风”2号设计成携带2万吨当量弹头，1966年10月27日核武器试验的正是这种弹头。弹性振动和推进剂供给泵失效产

生的许多问题使“东风”2 号导弹受到困扰。其第一次成功发射试验是在 1964 年 6 月进行的，[65]原确定的部署日期与第一次原子弹试验日期一致，已向后推迟了两年。在 1966 年部署“东风”2 号导弹时，中央军事委员会命令将其部署在中国东北的导弹的目标定为城市和美国在日本的军事基地。

后来出现的两种型号导弹是“东风”3 号和“东风”4 号。① 1963 年，中国设计人员废弃了“东风”3 号的前身“东风”1 号，因为 4 台发动机每台只能产生 16 吨的推力。后来他们从根本上改制了该导弹，有更大的推力（从 64 吨增加到 104 吨）和更大功率的可贮燃料（偏二甲肼与液氧、硝酸和四氧化氮）他们设计的这种新型“东风”3 号导弹，是 2800 公里的中远程导弹，弹头为尚待完善的热核弹头，于 1966 年 12 月进行了发射试验。作为军事运载装置，“东风”3 号能把弹头发射到菲律宾的美国军事基地。它还可以作为“东风”4 号和“长征”1 号的第一级，“长征”1 号是 1970 年 4 月发射中国第一颗卫星的运载火箭。到 70 年代末，“东风”2 号和“东风”3 号火箭在永久基地部署了“100 多个发射架，这些发射架大概都具有再发射能力”[66]。

中国于 1965 年开始研制“东风”4 号导弹，并在 1971 年开始首次部署。有限射程洲际导弹“东风”4 号可带百万吨当量的弹头，最大射程达 4800 公里。[67]中央军事委员会把关岛上的美国战略空军司令部的基地作为这一强有力系统的理论目标。第一级，即“东风”3

① 根据张钧主编的《当代中国的航天事业》，“东风”3 号（中程火箭）和“东风”4 号（中远程火箭）分别于 1966 年 12 月和 1970 年 1 月成功地进行了首次飞行试验。应当指出，中近程（medium-short-range，“东风”2 号属此类）、中程（medium-range）和中远程（intermediate-range）这三个术语所指的射程与西方所用的“medium-range”（中程）、“intermediate-range”（中远程）和“limited-range intercontinental”（有限洲际射程）术语的含意不完全一致。按美国国防部的分类方法，“东风”2 号为中程导弹，“东风”3 号为中远程导弹，“东风”4 号为有限射程洲际导弹。

号有 4 台发动机，第二级有 1 台发动机。在以后的 10 多年时间里，第二炮兵学院用第一级成功地进行了增程试验。[68]“东风”3 号和“东风”4 号导弹的射程较远，因而可把它们部署在安全的中国腹地。

1969 年，中苏爆发了武装冲突。北京命令战略火箭部队执行“八年四弹”计划，要时刻牢记新的敌人。苏联的一些城市立即成为指定的目标。1971 年组建起来的第一个“东风”4 号导弹部队转移到青海（小柴达木和大柴达木）和中国西北的其他基地，更靠近苏联的要害目标。

1965 年，中国开始研制“东风”5 号两级洲际弹道导弹，其最大射程为 13000 公里，可带几百万吨当量的弹头，攻击夏威夷和美国本土。中国组织两个竞赛小组来设计可部署在地下井内的大型导弹。一个小组分析不可贮液体燃料系统的优点，另一个小组则探讨可贮液体燃料系统的长处。几个月后，两个小组已对每一系统的优缺点进行了辩论，在辩论中，中国就已感觉到美苏 1962 年古巴导弹危机的严重性。大多数人认为，这次危机表明，不可贮燃料导弹在严重的国际紧张时期是无能为力的。这种导弹在迅速升级的最后较量中因准备时间太长而发射不成，并且不可能长时间保持戒备状态。与此相反，可贮推进剂使“东风”5 号导弹具有戒备率高的优点，因而能够长期保持发射状态。[69]

辩论结束了，中国设计的“东风”5 号导弹采用可贮液体燃料，与“东风”3 号和“东风”4 号的类似，但不完全相同。[70]尽管这种导弹 70 年代经过部分试验后早已开始部署，但研制人员直至 1980 年 5 月才对“东风”5 号导弹进行接近最大射程的发射试验。“文化大革命”使“东风”4 号和“东风”5 号计划付出很大代价，延误了时间。

“东风”2 号到“东风”4 号系列导弹的制导系统提供给战略部队的武器精度是有限的。在所有 3 种型号导弹中，石墨控制舵提供

姿态控制。[71]直至 70 年代末，① 针对苏联目标的“东风”5 号导弹开始部署时，中国人才安装了稳定平台惯性制导系统、方向推力室、微调发动机和旋转主发动机来进行姿态和推力向量控制。[72]关于制导和精度问题，张爱萍倒不大看重精度：“我们不必达到极高精度。如果中国和苏联之间爆发核战争，我想中国的洲际弹道导弹是命中预定目标克里姆林宫，还是命中莫斯科大剧院，两种结果并无太大差别”[73]。张爱萍暗示，问题在于能够在报复性打击中摧毁市区或“软”军事目标。

尽管不重视国家导弹力量的精度，但中央军事委员会却强调需要绝对的指挥和控制。中央军委认为，这种权威在所有情况下都是主要的，特别是由于中国的预警能力极差，并且与超级核大国相比处于全面的劣势地位。在 1959 年 6 月，第一个战略导弹营组建起来，归炮兵管辖。[74]后来在 60 年代中期，该营和后来相继组建起来的导弹部队脱离了炮兵，中央军事委员会开始把它们编成第二炮兵。为了进一步加强保密工作，调原公安部队的人员去支援二炮司令部和指挥中心。据中国的一则消息，在这时，中国导弹部队“在中国最高统帅部——中央军事委员会发出命令之前，不得发射任何导弹”[75]。1966 年 7 月第二炮兵正式组建，加强和集中了中国战略力量的控制体系。[76]

在可用技术的限度内，该部队创造出一种策略来提高中程导弹并进而提高较远程导弹的生存能力，即把导弹部署在能很好地躲避苏联和美国卫星侦察的岩洞和深山峡谷中。1974 年，美国国防部长指出：“中国人已清楚感到第二次打击能力的重要性，并积极努力把其战略进攻力量的易损性减至最小”[77]。3 年后，参谋长联席会议主席又说，中国的军事战略“似乎仍继续是防御性的，同时不放松遏制

① 直到 1980 年中国才进行“东风”5 号导弹横跨太平洋的全程试验，70 年代，这种导弹进行了减程试验，并于 70 年代末，可能是在 1979 年开始部署。

对其主要目标的攻击”。他指出，有效的威慑“并不总要求最高水平的尖端技术”[78]。中国导弹的指挥官们已同意这一点，他们领导人在军官会议中显得充满信心，因为他们现在部署了一支庞大的、不易受攻击的报复力量。

尽管毛泽东声称核武器不用作制止核攻击或控制战场的专用力量，但它仍作为官方政策而存在，中国开始部署战略力量这一种特有的战略，显然是与毛泽东的立场相矛盾的。[79]第一次原子弹试验成功时，广播公开宣布，中国在第一次打击时不使用核武器，核武器用于“防御，为了保卫中国人民免受美国发动核战争的威胁。”当中国有了可投掷的核武器时，美国“不要那么狂妄自大，他们的核讹诈和核威胁政策已不那么灵了”。北京懂得，利用其极弱的核力量来威胁它的敌人是不可靠的，即使真的发射核武器也没有自杀的危险，但它决不再犯莫斯科在古巴导弹危机中的“冒险主义”和“投降主义”错误。

然而，中央军事委员会却选择了建立一支拥有大当量、适当精度武器的力量，如果中国遭受核打击，这样的武器具有一定的生存能力和报复能力。按照毛提出的众所周知的核战争观点，任何人也不会怀疑，毛有决心命令实施第二次打击，连同几十枚生存下来的武器，使人们相信毛的预见：核武器计划能“鼓舞我们的勇气，灭他人的威风。”事实上，毛已利用最低限度的核威慑力量。聂荣臻在他的回忆录中把这一思想作了原则性的解释。发展战略火箭力量使中国能够“在我国遭到帝国主义核袭击时，有起码的还手能力”[80]。

据导弹计划的高级参与者说，“在 1956 年至 1964 年间，毛泽东描绘了社会主义中国的核战略理论的轮廓。”这种战略虽在执行，但不明显，这种战略依靠一支安全、较小的核运载系统去攻击拥有强大核力量敌人的“主要居民中心”[81]。关于 1969 年与苏联的边境冲突，中国声明：“如果一小撮战争狂人胆敢侵犯中国战略基地，……这就是战争，就是侵略，七亿中国人民就会奋起抵抗，用革命战争

消灭侵略战争”[82]。

对第二炮兵来说，这意味着在适当的时机用有限的核力量报复攻击北京自己选择的目标。某导弹发射旅旅长就这一使命义正词严地说：[83]

我常想：我们能够经受得住对方的第一次核打击吗？我们的战略方针是后发制人，处于被动的地位。但是，我们的敌人也怕我们已部署的洲际弹道导弹。因为他们不可能在第一次打击中，摧毁我们所有的导弹基地。

虽然稍有改变，但这一报复战略仍继续有效。[84]

在研究1955年至1967年中国关于核武器及其对现代战争和全球政治影响的观点时，我们已从理论实践上大致明白了中国的战略思想。在依靠苏联的最初几年间，正像1955年公布的文章所说的那样，中国重弹了苏联关于首先使用核武器和实施突然袭击的老调。当然，这些文章中，主要反映了中国面对美国使用核武器的威胁的恐惧心情。当这种心情消失后，中国的观点又回到了毛的“纸老虎”以及在核战争中得以生存的论断，因此又放弃了苏联的观点。在1955年至1958年间高级领导参与核计划的时期，最高领导人很少涉足于核哲学和核政策的迷宫。他们并不认为有必要提出或说明核计划的思想，或该计划对军事计划的影响。

在中苏关系日益紧张的年代（1958年至1960年），毛确实明确表述了他对核武器的看法。他在与赫鲁晓夫的辩论中，对可能导致核战争及其后果的看法，谈得比任何时候都更加详尽。毛泽东把核武器和远程导弹作为计算东西方力量均势变化的因素。按照他的看法，卫星使苏联在核武器运载系统方面占有明显的优势。战略力量成为中苏安全利益冲突的焦点，并有助于加速集团之间更广泛的冲突。

现在我们知道，毛泽东手下的军事领导人认为，将来引入了核技术军事思想会产生更大的分歧。他们肯定担心国家遭到像毛嘲笑

美国那样的核攻击带来的严重伤害。早在1957年，陆军就开始训练部队在核攻击下的生存能力，1961年开展了高级领导关于在“现代条件”下战术训练问题的讨论。指示团以上部队“探索如何使用我们的原子武器和化学武器进行突然袭击”[85]。到60年代中期，军事领导人已开始准备选择部队接收和部署核武器。据推测，教员不得不讲授有关指挥和管理战略部队的可行办法。正像我们已看到的，尽管在毛泽东讲出政策之前，没有一个人能清楚或系统地阐述其政策，但制定政策的信息广为传播。他没有讲，而且他在一生中也不允许开展无限制的发展战略研究。军事研究机构只在他1976年逝世后几年才开始研究。

核导弹的出现使战略思想同已宣布的政策及有关战略和战争的国家一贯方针发生了矛盾。任何一种技术也没有对国际冲突的看法产生如此根本性的对立，毛的世界观应该使他研究探索原子弹与其过时的思想相对立的“主要联系”。他忽略了这一矛盾，因而他失去了影响中国未来核战略的机会。

第九章　中国的教训与全球的核经验

中国核武器计划的成功虽然不能掩盖它经历10年的混乱和失败，但与这10年中遭到的失败相比，它确实取得了重大成就。这一对比促使我们在最后一章里尽可能评述一下该计划的成功之处。我们将从以下四个方面来阐述：该计划本身的演变过程的分析；中国的工作与其他国家的工作的对比；按一般标准估价该计划的成败以及对该计划领导人聂荣臻的总评价。

依赖、相互依赖和自力更生

中国核武器计划的演变过程为分析本书开头提出的问题提供了依据，也为描述中国计划的成功提供了基础。在序中，我们先分析了中国决定实施核武器计划的来龙去脉和当时的背景，尔后就领导、组织和科学技术的发展提出了一些问题。下面我们回过头来探讨一下这些问题。

我们的研究说明了中国共产党怎么正当大跃进年代恢复革命领导体制和准则的时候，同时改进或搜集科学技术和发扬革命传统来制造核武器的。改进已进行好多年了，其表现形式是一种规章制度不同于另一种规章制度，一次技术挑战与下一次技术挑战也不同。因为每个科学家和工程师以及地方采矿、加工、设计、制造和试验单位发挥部分作用，所以，认为核武器计划形成单一的规章制度是不正确的。按照社会科学的术语来讲，根本没有单一支配作用的模式，而有许多模式。其中的一些只适用于采矿或选矿，而有一些模式（即使是后来被废除了）却为该计划以外的其他领域的领导、组织和技术发展

提供了重要的教训和经验。或许最重要教训是：根本没有单一的方法或制度在如此复杂如此长期计划的所有方面起同样的作用。

然而，获得核武器过程的每一阶段——从铀的勘探到最后的核弹试验——建立起来的微型系统明显都是在聂荣臻最终像周恩来这样的政治局关键成员指挥下的更广泛的核计划之内运行的。正当允许搞地方灵活性和多样化时，该计划强化国家指导、协调并鼓励优化统一的原则。正是该计划的威力推动了领导、组织和技术的有效合作。

对不同国家的核计划进行比较研究证明，所有这些计划都利用了外来的知识和援助。外部知识是通过直接和间接、公开和秘密的手段得来的。这一错综复杂的事实使人们难于划清本国的和外国的界限。从这方面来看，中国核武器计划的国家管理经历了由中苏同盟发展决定的几个不同阶段。由中苏同盟发展决定的这几个阶段与英美联盟的发展阶段相似。例如，英国的军事核研究、发展和生产经历了渐进的变化过程，即除了英国初期依赖于美国之外，还与它们之间的联盟发展有关。[1]中国与英国一样，核计划的领导、组织和技术的发展经历了从依赖到相互依赖再到自力更生这样几个阶段，因为这几个阶段是由该国同盟关系确定的。中国这项计划的每一个行动自然都影响到领导、组织和技术并符合它自己国内的纲领和政治，但在内部每个行动彼此配合，并与国际上确定的阶段密切相关。因此，我们分析领导、组织和技术对该计划成功的影响时，不仅必须研究它们彼此间的相互作用，而且必须研究各阶段变化带来什么样的影响。

在 1955 年至 1958 年的依赖年代，中国就预计到并采取自力更生的方针，但把他们的直接决策和组织纳入了苏联的轨道。正像我们看到的，苏联政府虽然表现出很大方，但是它对中国也提出了些苛刻的要求和限制。苏联把中国看作学生和下属盟友，而中国对其导师给予了极大的尊敬。因为依赖苏联的科学和技术，北京的核武

器计划可能付出了代价，在训练、资源、设计和设备方面的收益，保证了该计划的迅速发展，保证了产品的质量以及该计划的生命力。依赖性也导致了中国内部在战略和常规计划以及管理这些计划的军政领导人员之间的关系紧张，并助长了持久的分裂。

核计划在最初的几年里，确实显出了信心及有计划的实验方面的不成熟，但重点明显落在涉及到高水平政策的管理上。领导层承担了这一重担。对美国的威胁和本国核资源与能力的估计，以及与克里姆林宫的定期谈判，促使中国最高层军政领导人携手共事。这些领导人拟订初步计划，接受与科学家联合，确定管理人员和组织体系并授以权利，定下高风险的调子。

毛主席对世界的看法，把中国人对自力更生的最终目标和依赖苏联援助的权宜之计思想弄得模糊不清。当中国需要科技专家的技能时，毛总感到与他们合作令人烦恼，把他们作为合作者让其在一旁工作。他的这样一些思想方法传给了任何以自力更生发展核武器最终必须依靠的科学家。苏联的因素进一步增强了毛对依赖靠不住的同盟（不管是国内的还是国外的）的不安。在依赖的年代里，毛既要求又厌恶苏联的援助。他基本上把潜在的同盟者看成是对手，因而不能平等相待，并且对别人倡导的或他不能控制的变革或想法反应冷淡。当毛的头脑仍像革命战争年代那样十分清醒的时候，他只是偶尔地对核武器计划实施坚定或有效的领导。总的来说，当毛的思想集中在革命的最终命运上时，他对核计划往往是采取回避，甚至是冷漠的态度。

政治局为执行核计划最初建立起来的组织体系是试验性的，而且没有长期坚持下来，科技界尚未有足够的力量或自信心对领导层的指导方针产生重大的影响。在这个依赖阶段，领导仍把国家的依赖作为最终目标，并试图选择一些方法来平衡短期依赖目标和长期独立自主目标之间的竞争要求。但是，依赖使得中国对长期目标采取灵活的态度，几乎是逆来顺受的态度，并集中精力实现最接近的

目标。正在这时，北京的高级领导人为能够发挥其最大的潜力来影响核武器计划而感到高兴，但他们能够付诸实践的机会却最少。因此，苏联的帮助迫使他们打算尽快摆脱这种状态。

与莫斯科的合作给中国的战略观点留下了长期的影响。合作使北京在某些技术方面走了捷径，并为中国人留下了可称之为一种简略的教科书，供他们尔后学习和使用。在中国处于依赖地位的情况下，他们主要是仿效苏联的军事原则或者按毛泽东的先人之见来修改苏联的军事原则。由于在中苏核合作年代接受了苏联的援助，中国没能及时认真考虑其作为一个独立核国家的未来状况。

尽管中国高度依赖于苏联，但是中国和苏联的核计划根本没有达到两国一体化。虽说中国是莫斯科的十分顺从的学生，但反对苏联把中国对其依赖的范围由技术援助扩大到共同防御战略或导致苏联军事渗透新花样的动机。没有任何核依赖最终成为联合一体化的核武器计划，中国对苏联的依赖也不例外。中国在向苏联方面学习的同时，严格保持所有核武器国家具有的独立政治——战略意义的特点；这种独立可能是所有原子计划得以存在的原因。

相互依赖的年代（1959 年至 1960 年）不同于前一阶段，因为中国这时在通向原子弹的两条道路中更加强调走自己的路。这一变化大大激化了中苏的紧张关系，并且为即将出现的争论打下了基础。这导致莫斯科取消了提供原子弹样品和供兰州使用的六氟化铀这样一些贵重的战略物资。

相互依赖作为核武器计划中的一个阶段，也与大跃进及它的失败相一致，这一时期整个国家的组织体制经受了严峻的考验。这种体制在其官僚主义最严重的地方是毛的改革的主要目标之一。到这一阶段，苏式的各机械工业部和中国科学院各研究所被证明在组织上不适于实施核计划，特别是当群众运动和经济政治变革已表明需要保持这一计划的稳定性和连续性的时候。在这时，政治局的高级领导人不能很好地处理与莫斯科的战略关系，也不善于管理 1957 年

反右斗争中受到威胁的该计划的知识财富。组建强有力的特种军事科学机构的任务落到高级计划官员的身上，诸如由周恩来支持的聂荣臻和宋任穷。他们利用孤立分散的勘探、设计、生产和试验设施，依仗强有力的私人关系、保密的需要和地区偏僻的原则组建了新的研究所。聂荣臻为建立组织充分发挥了天才，这种组织体系为以后20年的许多重要试验做出了贡献。

在聂荣臻及其助手管理的工作范围内，地方组织体系采用新的组织方法，以便在迄今对立的双方——军队和民众、科学家和工人、中国和苏联之间形成牢固的关系。以前从没有这样做的人自那时起合作得很好。这种新事物以多种形式建立起来。我们已指出聂荣臻领导的研究体系内组织机构的多样性，而且这种多样性是重要的。人们可以把这种组织机构的多种形式与游击基地比较一下，这种基地在革命战争年代，延安的权力虽然分散但却很有权威。在长期斗争和持续劣势的驱使下，中国共产党不得不遵循列宁的民主集中制原则：在作出指挥决策之前积极参加讨论，而后必须坚决执行。在革命的环境下，严格的统一和自上而下的指挥是不可能强迫建立起来的，否则可能是自取灭亡。在核计划的相互依赖阶段，中国又试行了组织多样化和自上而下的作法。当聂荣臻建立国防科学技术委员会和为整个计划建立全套组织机构时，这些作法似乎为他效了劳。他领导的国防科委不是在教条主义或盲目服从的基础上建立起来的组织体系。这就是其成功的秘诀。

独立阶段是从1960年夏季苏联专家撤退开始的（并非出自中方自己的选择）。中国把1960年至1962年称作“站稳脚跟的年代”。[2]苏联专家的撤退引起了中共当局对战略武器计划前景的重视并激起了高级领导人的冲突。这一冲突使聂荣臻控制下建立起来的体制进展暂时陷入困境并受到非难。“三年困难时期”（1960年至1962年）的经济灾难，使有特权的机构及其优先供应问题承受了更多的压力。中苏联盟的分裂和美国在东南亚进行军事干涉造成的威胁也接踵而

来。

除权力或计划之争而外，从相互依赖到独立的过渡也是国家重新肯定和重新统一的时期。政治局采取行动组建了一个联合工作小组监督计划的执行。正像一位中国专家所说的："这是我们并肩战斗的时期。"继苏联专家撤退之后，北京曾一度坚持中央的领导和组织体制并继续推行了一贯政策。资料、计划方案和顾问的撤除所造成的问题严重地影响了铀加工和浓缩设备的安装。在国家非常时期，许多领导都争先恐后地关注原子弹问题。毛也亲自解决争端的问题，并指示建立了15人专门委员会。这一机构具有重大的象征意义，因为战略计划已适应了完全独立招致的创伤。该委员会虽然充分发挥了行动一致的作用，促使核武器计划向前迈进，但是却没能结束官僚主义之间的冲突。

于是，国家领导和国家机构又一次在较短的时间内对计划起到了决定性的作用。新阶段的巨变使这一作用成为重新执行计划不可缺少的先决条件，而在这方面的关键人物是周恩来。他的重要地位、负责精神和领导才能使他为在获取核武器方面的所有有关领导树立了榜样。这种一致意见没能持续到"文化大革命"第一个回合结束，不过到这时，中国已成为一个核国家。

由于1962年回避了原则争论，独立自主的全部内容贯穿在整个计划之中。现在该是专家出头露面了。在以后的两年内，稳定的和抱支持态度的国家领导和组织机构为给予中国科学家和技术专家一定的决定权而不再突出。1962年至1964年这几年叫作"开花结果阶段"。在这一"紧张而令人兴奋的时期"，中国技术人员解决了两大难题：浓缩铀的生产和中子引爆器的设计。[3]

中国领导力量和技术专家的共存关系，正如戴维·霍洛韦所说的，把"核武器发明中的奋力需求与大力推进发明"结合在一起。[4]北京的高层领导的确向科学家和工程师提出要求和最后期限，而且这些要求和期限被理解并受到尊重。但记录表明，在大多数情况下，计

划性的要求的实质和水平均来自专家本身，中央当局指望科学家提出现实的目标和确定具体的技术途径。

这些专家向计划的领导和组织机构提出了许多最使人为难的要求。到核武器计划的独立自主阶段，这些要求中最重要的是工业和工程应用，而不是基础科学和高水平的政策。解决工程中的问题需要一种发明和创新的精神，而且许多“科学”突破和“技术”革新必须使政治和官僚体制在与科技系统开展全国性大协作的新模式中进行实验。当管理规章制度充分发挥作用时，革新方案和工程设计一开始就起到了良好的作用，或者由各级专家以极好的互助精神通过试验和失误后进行修改。

中国的核武器计划（像其对手苏联一样）能够克服官僚主义的惰性和党的反知识分子的保守主义。给予核武器计划的特殊优先权使研究和生产单位有真正的自主权，并且使技术权限与思想教条平起平坐。1960 年至 1964 年的独立自主年代，促进了较大程度的分权管理制度的出现，并使大多数业务单位从过多的官僚主义繁杂公务中解放出来。高级领导人员深入研究计划的实质，试图在其庞大而设备简陋的王国与研究、生产及试验设施之间搭起一座桥。就 60 年代政治制度的异常程度来讲，北京避免了粗暴的干涉或不适合的微观管理。

中国非常关注国家的独立，因而加速了它的发展进程。尽管致力于主权的完整，但中国不能逃避核地位的束缚。在中国像其他国家一样，拥有核武器使国家处于不利的有核地位：这样的国家承担空前的风险。获得核武器始终破坏惯用的民族主义模式，并驱使核国家为生存而暗中相互容忍。虽然中国十分孤立的地位使其计划人员忘却效仿，但核武器的确使北京更加警惕。中国对全球的核体系虽然缓慢却强有力地作出了反应，并公开承担控制核武库的特殊义务。因为必然察觉到世界上大多数核规划者的限制，因此中国一步一步地着手规划其国家核力量。核武器本身而不是苏联限制了中国

的防御规划。究竟是什么首先使北京的决策人发挥作用，又很快将其束缚起来呢？

中国情况与核历史的比较

在人类发展史中，地球上几乎没有哪一次发现能够与铀原子核裂变的突然发现及以后迅速发展原子弹相提并论。物理学家和一些其他科学家逃离纳粹的专横统治，与来自英国、加拿大和美国的同事首先在研究中尔后在曼哈顿计划中合作。美国的工业犹如黑暗世界的一盏自由的灯塔，对该计划作出了具有决定意义的实际贡献，不过科学的曙光决非只照到一个国家的旗帜上。许多国家的天才分享了令人激动的欢乐，使阿拉莫果多沙漠内“巨大的耀眼火光”腾空而起。由此看来，中国的计划使这一火光继续在全世界传播，对中国计划进行评估时必须把它的特点与全球的进程区别开来。

随着裂变的神秘威力被人们所认识，上述的畏惧也冲击了哈恩、迈特纳、弗里西、费米、皮埃尔夫妇、玻尔、西拉德、库尔恰托夫、维格纳、惠勒、贝特以及钱三强、彭桓武和王淦昌。这些人和少数其他中国人与国际物理学家结成兄弟友谊，他们被苏联物理学家雅科夫·弗伦克尔称作“狭窄的特权阶级”，[5]裂变这一科学奇迹及其潜力使中国的男女科学家欣喜若狂，正像喜爱那种兄弟友谊一样把他们吸引过去。必须指出的是，美国的狭隘观念胜过中国特有的狭隘观念。

正像追求裂变军事潜在应用的其他国家一样，中国在全球这一激动时刻的狂欢也为实力政策所淹没。中国首批核武器的历史再次表明科学历史上一个战略阶段的国际主义和表明在全球理解这一阶段的普遍意义时缺乏辨别力。

在承认政策和人的缺陷的同时，我们还必须回答各国核武器和发展核武器意义的一些问题，探讨中国这样一些问题的一种方法是通过比较来分析其经验。不过不应低估进行有效比较的难处。由英

国计划的玛格丽特·高英和美国计划的理查德·休利特、奥斯卡·安德森或理查德·罗德进行的划时代事件的研究是靠大型数据库，这对中国简直不适用。戴维·欧文为把他参与德国流产的核武器计划的历史写出来，同样利用了丰富的文献档案。虽然戴维·霍洛韦对苏联的计划进行了全面研究，[6]但对苏联和法国计划研究的较少。

如果把我们对英国计划和美国计划了解的情况与我们了解的中国核武器发展情况加以对照，我们就会发现中国资料中的一大片空白；因此我们不得不满足于关于中国有关人员、政策和技术问题、资源、工业设施和辅助基础设施以及试验结果等很少的信息。高英(Gowing)对英美核领域合作的起伏进行的详细研究远远超过对中苏合作进行类似探讨的可能性。另一方面，中国透露的情报比苏联或法国更唾手可得。我们只有很少苏联和法国的可靠资料。如果我们了解并记住这些有限资料，我们就可以试图进行初步的比较评估。

让我们开始对英国和中国在核武器发展历史中的作用进行比较。研究美国核武器计划时经常忽略在英国的科学家（一些英国人和一些难民），却是“在第二次世界大战中首先确立原子弹可行性的人”[7]。1940 年秋，代号为“茅德”（Maud）的英国科学家委员会与美国的相应委员会建立了联系。1941 年 7 月发表的“茅德报告”证明，该委员会在获取执行中的美国曼哈顿计划方面起到了作用，甚至是决定性作用。尽管英国人在曼哈顿计划中作为辅助和密切的伙伴被束缚得很紧，但是他们却作为体面的合作者对这项计划作出了重大贡献，例如在铀的分离和原子弹的制造方面。另外，像约翰·科克罗夫特和威廉·彭尼这样一些科学家还把无法估价的经验带回去贡献给英国本国的战后核计划。[8] 美英合作随着 1946 年 8 月美国原子能法生效而突然结束，但是在 1947 年 1 月，联合王国决定实施独立的核武器计划时，英国根据与美国的 5 年牢固关系的基础继续进行合作。

中国作为苏联核武器计划的参加者没有得出同等的经验。主要

是，苏联对中国核计划的支持按规定是有限的，是单方面的科学、技术、工业援助，而不是合作者间的联合。当然，中国的防御科学技术计划，正像我们已看到的，包括核武器工作，在很大程度上曾受益于苏联的援助。但是，中国从来没有像美国计划中的英国同行那样进入苏联核设施的秘室。据报道，虽然少数的华裔在美国战后试验计划中担当过外围角色，后来回到了中国。[9] 但据我们所知，没有一个中国人直接参与苏联或西方的武器计划。我们已经注意到在西方的非军事核物理实验室里的这些中国人的背景情况，但是他们的作用与曼哈顿计划中的英国人所起的作用不同。

华盛顿和莫斯科分别与其盟国英国和中国结束了原子的相互依赖关系，从而引起了抱怨和相当大的误解，尽管伦敦和北京都知道对他们的更强大的盟国感激不尽。当原子合作在中国破裂后，这种破裂在一定程度上引起和影响了联盟基础的解体。核武器政策及获得核武器无疑加剧了与莫斯科联盟的分裂并加速了两国关系的破裂。相比之下，英美的松散型公司并没有发生政治分裂，各走各的核道路。为了刺激其他欧洲国家，英美的伙伴关系坚持下来，面对战后西方与苏联关系的恶化，这种伙伴关系成为北约联盟的核心。制造独立的核计划决策不会引起政治危机或对盟国产生无法控制的敌对行为。

第三个和第五个核大国——英国和中国早已得出结论，独立的核武库会大大提高其国际地位[10]。这两个国家深信，成功地获得核武器必将使其防御能力和技术能力发挥作用，并显示其未来的军事潜力。这可能得到朋友和敌人的同样承认，当大英帝国和中国爆炸了它自己的第一颗原子武器的时候，这两个国家的公民把爆炸作为胜利的象征而为之欢欣鼓舞。正像玛格丽特·高英的评论所指出的，在英国的第一颗原子弹爆炸时，“因怀疑创造原子弹的道义性而发出的呼声寥寥无几”[11]。在中国，人民大众会将约翰逊把 1964 年 10 月核爆炸当成“中国人民的悲剧”的描述视作笑柄而嘲弄。[12] 10 多位中国

目前的领导人曾在战略武器计划中占有重要地位不是偶然的。

直率地说，中国和英国获取核武器的决策出自完全不同的动机。在50年代，美国政府曾企图在朝鲜、印度支那和台湾海峡部署有限的核武器来威胁中国。华盛顿制造的威胁在于使苏联领导人不敢对美国的盟国轻举妄动。美国害怕和反对核扩散的人会清楚地记得，正是美国使中国的核计划成为中国安全至关重要的计划。这样看来，北京的决策比英国获取原子弹的决策的真正军事理由更加充分。

在高层政策和雄厚的科学之间没有形成联合的情况下，核武器计划根本不能成功。当人们问为什么纳粹德国在原子弹的研究方面成就甚少时，前帝国部长阿尔贝特·斯皮尔曾说："我们从未越过实验室初期试验的阶段，甚至也没越过这个阶段的决策。"未解决科学问题也是原因之一。但是，戴维·欧文曾得出结论，德国核科学家不能"用原子裂变的可能性点燃斯皮尔的想象力是他们的最大缺点。"欧文谴责这一失败是由于科学院物理学家胆小造成的，所以"他们没有与政府或工业界的大人物建立起和睦的关系，是不足为奇的"[13]。

自从苏联科学院主席团1940年6月批准建立以放射化学家B. Г. 赫洛普金为首的铀委员会以后，苏联科学家与克里姆林宫官员的关系密切多了。[14]但是此后不久，苏联科学家队伍本身，因对原子能的未来可利用性（包括其军事潜力）的看法不同而发生了分裂，并且再也发挥不了令人信服的影响了。这些科学家中的许多人不同意伊戈尔·库尔恰托夫对裂变的军事应用所持的乐观主义态度，并断言任何技术和军事应用乃是几十年以后的事情。只有库尔恰托夫和少数同事，诸如物理化学研究所的Ю. Б. 哈里顿，高举拥护研制的旗帜，没有因"其能够接近政治领导的威望或声望"而忘乎所以。30年代斯大林的清洗运动给苏联军事留下了缺乏想象力和不称职的专家，战争把所有研究计划的资源，特别是十分缺少的资源掠夺一空。按照霍洛韦的看法，斯大林既不懂得原子弹的潜力，又"不会决定

扩大研究规模”，即便他看到了这种可能性。但是，斯大林知道德国、英国和美国正在研究原子弹，这使他在1942年制定一个小型计划；在广岛遭到原子弹轰炸之后，此计划变成了压倒一切的任务。正是广岛事件而不是苏联科学家最后说服了斯大林及其后继者开始听取或勉强听取卓越科学家的意见。

在中国，党的反智力活动的历史并没有阻碍像钱三强这样在政治上享有优越地位的科学家增强信心和激发高级官员的想象力。他们对中南海承担的任务比第二次世界大战期间维纳·汉森伯格对斯皮尔军械部或伊戈尔·库尔恰托夫对克里姆林宫承担的任务确实要容易得多，因为中国的领导人毛泽东知道原子弹已研制成功。另外，钱三强在科学上和政治上是可靠的，他作为科学界和杰出人物间的媒介起到了应有的作用，因而他在北京比库尔恰托夫在莫斯科受到更多的关注。钱三强在西方享有的威望主要是由于他接近周恩来和聂荣臻。他在科学上的作用比不上伊戈尔·库尔恰托夫，他本人并没有起到人们认为那样的核武器计划中心人物的作用。

科学家和官员之间的卓有成效的友好关系是计划成功所必需的，它不能确保计划成功。在任何情况下，(包括中国) 国家政策和原子弹计划之间的合作也不会完全顺利地进行。但是，每一项成功的计划，政府促进规章制度的整顿，就能使人们形成自我约束和忠于职守的美德，并且能够克服助长官僚主义惰性的风气。

英国和中国的计划表明，他们也具备了美国曼哈顿计划中表现出来的激情和承担义务的精神，并且是在极其不同的政治和工业——科学环境中再现出来。这些特性有助于按西方模式独立地实现高度现代化和科学技术的发展。他们并非受国家意志所支配。高英所说的“英国财力敞开供应，优先权得到保证，因为部长和官员同样懂得原子弹使战争革命化”[15]这一点，也完全适用于中国。这样说并不是为了与英国比较，我们只是试图说明中国的决心如此深刻和百折不挠的理由并不只是出自美国的威胁。的确，中国的有关消息

暗示了这一点，因此国外侵略危险的存在只能部分地解释这种忘我的奉献精神。领导对国家的科学威力或潜力的长期承担义务和信任起到了重要作用。

国家的决心只要有一点差错就会导致不堪忍受的失败。政治气氛不需要天天去干扰。要使政治脱离计划的直接决定似乎会提高政府的工作效率。至少在中国，北京的指令，特别是发自毛及其政治局同志的指令有一个神秘的法令范围，因而许多指令在部长级范围内（包括许多政治和经济的官僚主义支持者）是作为决策而被通过的。他们避开了政治上的对立，并在非常时期确保了有限度的互不干涉。没有这一切，下级人员的无私精神可能大大降低，具有一定革命经历的权威指导者、摄政者和支持者首先明确鼓励这些人的非凡团结精神。

严格的保密制度所规定的纪律没有促进进一步解释那种信奉。虽然军事体制在中国的早期计划中比在英国和美国的计划中可能起到了更大的作用，但是军事保密制度却掩盖了所有的核能计划和核武器计划[16]。然而，霍洛韦认为，苏联的军事顾问“似乎并没有参与制造原子弹的决策”[17]，秘密警察曾把严格的保密制度强加于苏联计划。中国在制定其计划中有选择地采用了苏联的保密规则，但是限定了这些规则对计划内部工作的适用范围。保密义务主要是由计划内部产生的，而不是简单强加的。

集中和权力是苏联整个制度的特征[18]，中国计划当然也在一定程度上表现出这些特性。但是罗布泊核武器试验基地的建设可能是例外，中国几乎只依靠精锐的工程兵部队而不是犯人，并且提倡核科学家和技术人员进入有声望的战略武器机构。中国迄今的狭隘组织机构不得不接受普遍确定的知识和性能标准来保证计划的成功。苏联对中国核武器计划的影响比对其军事工业体系的任何其他计划都小。这在毛以后的时代增强了中国的威望。

改变革命模式是为了适应和容许持某种怀疑态度的知识分子的

需要和满足像战时环境下的贫穷落后社会的工业技术要求。尽管参与核武器计划的所有中国人员迁移到基地、工厂和研究所，住进了酒泉专区、青海省及罗布泊等地的军事帐篷、秘室内，但是他们仍觉得像是在研究室，而不是像在延安的兵营或窑洞内。在其无名的偏僻处所，“狭窄的特权阶级”却成了严加保护的友爱集体。党和中央军事委员会指挥的基本上是军事研究工作，这项工作既受军事支配，也改造了军事。

管理准则和个人动力

在中国，凡参与核计划的人都意识到，至少在实践中，科学技术决策不得不留给专家去作。在核武器领域，中国真正的革新在于允许并委托他人进行政治体制改革，以便把艰苦的工作留给非政界专家。在与军政指挥机构的合作中，科学家只要与政治领导的专业部门乃至最高权威在大多数政策问题上取得一致意见，哪怕是表面的一致，也算得到了报答。科学家和工程师或技术员间的合作也得到了发展，因为对核武器方面的所有问题，所有人员都在实践中学习。在这种情况下，红与专——政治家和技术专家合作得很成功。由于中央机关体系在文化大革命中被破坏，正当核武器计划的某些成员成为周围混乱的牺牲品时，这种特殊的关系仍得以维持下来。

作为政治和业务联系的一个结果，中国的核计划展示了重要的管理特点，从以后给出的各项内容看，这些特点将成为大型的成功防御的基本要求[19]，即明确的指挥渠道、稳定、要求少的报告、小型高质量的参谋机构、与用户的联系以及样品的制造和试验。下面，我们将把上述的每一特点与 60 年代初的中国核武器计划联系起来概略地分析一下。

在核计划的每一阶段，现场指挥人员都明确为其组织负责，并通过短而清晰的指挥线路与北京的领导人取得联系。聂荣臻对计划负全面责任，他经常直接向 15 人专门委员会和中央军事委员会报告

工作。当政治斗争败坏了聂荣臻的威望并削弱了其指挥系统时，计划就蒙受了损失。不过总的说来，政治局知道削弱聂的根基就等于破坏计划本身。过一段时间之后，周恩来总理再次恢复了聂荣臻的职务，加强了他的地位。

正像我们已看到的，核计划并没有避开50年代和60年代的社会混乱局面。但是，也正像我们讨论政治与技术结合时所指出的，领导竭尽其全部政治热情和经济资源来维持计划的稳定性，至少是最低限度的稳定性。就我们所知，聂为维持计划的性能标准、时间进度和预算的不变，进行了不懈的斗争。他一再向其同事和下级保证说，政治局一贯支持此计划，党和军事领导人提出稳步踏实前进的口号。当人们把计划的稳重口号和坚定信念与大跃进或“文化大革命”的歇斯底里的醒目标语加以比较时，差别是非常惊人的。如果毛及其同事重视整个中国现代化计划的稳定性，中国自1957年以来的历史就会蒙受很少创伤。

就其积极方面来看，正像在其他事业中一样，群众政治运动有助于在核计划的执行中把官僚主义的习气和过多的报告文件减至最低限度。50年代末的反官僚主义潮流保证领导干部机构革除了使地方行政人员和专家窒息的风气。群众运动还能够因开采了第一颗原子弹使用的燃料的铀矿而赢得荣誉。由此可见，正像我们指出的，甚至当新补充的科学家和工程师提出要提高决策和计划监督的质量水平时，计划管理机构的工作人员仍很少。

我们对与用户的联系特点了解得很少。中国的军事和政治官员不得不坚决主张02计划的严格保密条例，军方把组建控制战略武器部队——第二炮兵推迟到60年代中期。毛的革命法规贬低了所有军事硬件的地位，他不朽的威望延误了重新考虑确认和授予潜在用户资格的战略时机。高级军官可以充当行政长官和理论家而作为潜在用户。把中国的计划与其他国家成功的核计划加以比较时，我们为他们所有早期阶段实际上没有军事战略计划人员参与而感到惊讶。

我们确实知道，中国把导弹和航空工程师送到宋任穷领导的第二机械工业部，知道聂荣臻领导的国防科学技术委员会在1956年至1965年间与整个战略计划内部的所有部门包括五院的导弹设计分院保持着密切的联系。可是在获取核武器的最初几年内，保密制度阻止了最终军事用户的直接参与，而这种参与，当计划成熟了和试验装置向可使用的武器过渡时，越来越至关重要。随着时间的推移，中国做了大量工作来加强用户和设计人员间的有效联系。

最后，我们亲眼看到了中国在极其简陋的条件下专心致志地试制样弹和进行试验的情况。担心失败和对苏联顾问的怀念为中国计划内部的狂热鼓吹者制造了一种媒介，并确保发挥严格检验未经证明的技术、方案和方法的好风气。另外，计划已赢得了绝对优先权，聂荣臻可以更加灵活。这一优先权和冗余度，在无法进行直接认识或采用适合的理论时，允许采用系统的费时的试验方法。总的说来，采用试错法进行的寿命试验防止了计划费用的飞速增加。而且，在探索可行的分系统样品时进行的后续寿命试验可以说明，中国为什么对进行大规模全尺寸核试验的兴趣不大。

在对中国核计划的成功进行解释的过程中；我们发现此计划在很大程度上使用了某些甚至所有重要的管理特点；而其他武器计划在这点上仍是不明确的。然而对解释中国计划在培养积极的奉献精神和高尚行为方面的能力来说，可能同样重要的是政治制度给中国科技界人士一项挑战性的历史任务。虽然有一些重大错误和过失，但是毕竟把面临这一挑战所需的优先权和工具交给了他们。正像邓小平所说的那样，他保证，失败了他负责，成功了为别人请功。政治家使中国的科学家和工程师能够平等地参与现代史上的最鼓舞人心的技术革命。专家不仅懂得这一任务，而且懂得这一任务是光荣的。

我们已了解了由科学家、士兵、技术人员和政工干部组成的这支队伍以创造精神和高超技艺的团结协作，并以此为荣。对中国来说，这一历史任务恰是展示其科学能力和永恒社会价值的良好时机。

正是聂荣臻的组织天才，认识到并建立起一致的利益。核计划中的大多数设施非常保密并处于极偏僻的地区，这可能增加了冒险，因而答应给参与者以较高的报酬。

人员的极大主动性无疑鼓舞了参加高报酬冒险事业者勇挑重担的忘我精神。首先，每个人都能够把计划的目标以及决策和测量结果的统一标准看作是国家的要求。参与者相信，达到这些目标能够受到广泛的重视，并为国家和他们自己产生长期的效益。他们深信，每一个有才能的人都能够做出重大贡献，并且允许他们这样做。其次，想得更广一点，该项计划得出的教训和方法是可以传下去的，供其他事业的参加者长期借鉴。再次，参加此计划的大多数人显然是被神秘感和好奇心所驱使，并且为其享有接近高级领导和贵重资源的优先权而高兴。他们觉得个人也接受了核计划的委托，甚至在事故可能危及其生命的时候也是这样，按照我们的判断，在出现困难和成绩时，这些因素都战胜了外来的威胁和个人失败的恐惧心理。大概中国科学家和领导人最担心的是：苏联科学家的存在和威望会贬低他们自己的作用和权威。独立自主对参与核武器计划的每个中国人来说，具有极其巨大的意义。

然而，毛泽东不大理解聂荣臻动员和组织这支勇于奉献而又有才能队伍的过程中所起的核心作用。毛泽东肯定不知道怎样维持这支队伍的能动性。的确，在“文化大革命”中，他几乎扼杀了人们的能动性。从这种意义上说，我们可以得出结论，政治体制在执行大规模技术计划时承担了很大的风险。成功的原因错综复杂，众说纷纭，并且很少为参与者尤其是最上层的参与者所认识。

聂荣臻对战略计划的评价

中国核武器发展计划的领导人聂荣臻对该计划的正反两方面进行了评价。他这样做是为了“总结”本国的经验，并把主要教训传下去以资借鉴。总结在中国的政治生活中占有特别重要的地位；它

是作出决策和取得统一的一种形式。[20]聂荣臻对核计划的总结作为本研究的结束语，是当之无愧的。

聂荣臻的评价强调该计划的正确决策而不是党在执行这一战略计划中犯的错误。他认为，从1956年到1966年党“确实犯了一些严重错误”。第一个错误是在大跃进中，那时干部表现出“一种骄傲自满和浮夸的倾向，并过高地估计了科学研究的成就”。在这一时期，科学研究的混乱而又分散的管理是“认识上的不一致”造成的。正像我们所看到的，聂荣臻想到并倡议1958年进行的组织机构改革来纠正这种错误的管理方式。在不加限制的群众运动的大跃进年代里，形成了“违背科研工作规律”的盲动。科研体制的不稳定是无休止的、不切实际的政治辩论和“党对知识分子的政策经常受到干扰”造成的。聂认为：“这些失误和缺点使我们不能在科研工作中取得更大的成就。直到今天，这一教训仍值得注意。”[21]

在开始评价该计划成功的原因时，他高度赞扬了在动员和鼓舞中国最优秀的青年科学家方面的胜利。在这一计划开始后不久，他撤消了责成国家计划委员会和教育部分配高校毕业生的命令。此后，党中央委员会批准了聂荣臻的建议，责成国家科学技术委员会、国家计划委员会和教育部共同负责高校毕业生的分配工作，但授权他领导的国家科学技术委员会单独负责分配研究生和进修生。因此，他认为“每年优先分配大量成绩优秀的大学毕业生到科研战线上来已成为可能。”[22]在此之前，彭桓武、朱光亚和邓稼先等一流学者已在与核弹计划有关的核物理和其他领域里组织实施了培训计划。正在成长的一代学者已被送往苏联和东欧进修。聂领导的委员会继续控制经过培训的优秀年轻毕业生为战略计划服务。

聂认为，党中央委员会的慷慨支持是计划成功的第二个主要原因。更全面地讲，毛针对知识分子的反右派斗争及大跃进严重损害了02计划。聂荣臻断言，党中央委员会在困难时期采取的对策拯救并推动了此计划。他指出：“党中央通常对尖端项目（核武器和导

弹）在物资上优先供应。虽然当时（60 年代初）国家财政十分困难，但每年仍拨出专款用于研究与这些计划有关的新型原材料。”[23]他说，中央委员会打破常规，允许国防科学技术委员会“直接向有关部门下达命令”。中央军事委员会发出特别公函，要求有关单位完全服从该委员会的命令。

聂说，“大力贯彻协调与合作”的指导原则，保证“原子弹和导弹计划的顺利发展”。他指出，政治、军事、科学和技术独特的合作关系并不是偶然出现的，是通过人们的艰辛努力才形成的，为此需要提倡新的姿态、组织和实践。聂促成了这一合作，并不断排除困难和干扰使其继续发展。另外，协调和合作的环境“带动了几个新的工业部和新兴学科的建立和发展，推动了大批新型原材料、精密仪器仪表和大型设备的发展。”

在最后的分析中，这位核武器计划的领导人用自力更生、严明的优先顺序和国家的骄傲这些赞语总结了战略核武器的成就。他说，依靠中国自己努力的政策，“不但是正确的，而且是至关重要的。”如果只依靠外援和购买外国的技术，就可能推迟研制的进程，并“使我们在外国的控制面前无能为力”[24]。正像 50 年代他向下级指出的那样，很简单，“谁也不可能把最先进的东西给别人。”这一事实是后来制定国防政策的“基本原则”[25]。

关于优先顺序问题，聂荣臻称赞国防计划能够得到“新型原材料、精密仪器仪表和大型设备”，这些就像家庭中的“几种日用必需品”一样。他征求同事的意见以取得一致的看法并要求优先保障国防需要的必要物资。否则，战略计划“就根本不能发展”[26]。

在装有核弹头的试验导弹发射成功几年以后，聂重新唤起了他 1966 年 10 月 27 日的激情。在那兴高采烈的时刻，他回忆说：“我为我们这样一个长期落后的国家终于拥有这种尖端武器而感到欣慰和自豪。”[27]聂是代表此计划的所有参加者，实际上是代表全国人民说这番话的。

附录 A　中华人民共和国政府声明

（1964 年 10 月 16 日）

1964 年 10 月 16 日 15 时，中国爆炸了一颗原子弹，成功地进行了第一次核试验。这是中国人民在加强国防力量、反对美帝国主义核讹诈和核威胁政策的斗争中所取得的重大成就。

保护自己，是任何一个主权国家不可剥夺的权利。保卫世界和平，是一切爱好和平的国家的共同职责。面临着日益增长的美国的核威胁，中国不能坐视不动。中国进行核试验，发展核武器，是被迫而为的。

中国政府一贯主张全面禁止和彻底销毁核武器。如果这个主张能够实现，中国本来用不着发展核武器。但是，我们的这个主张遭到美帝国主义的顽强抵抗。中国政府早已指出：1963 年 7 月美英苏三国在莫斯科签订的部分禁止核试验条约，是一个愚弄世界人民的大骗局；这个条约企图巩固三个核大国的垄断地位，而把一切爱好和平的国家的手脚束缚起来；它不仅没有减少美帝国主义对中国人民和全世界人民的核威胁，反而加重了这种威胁。美国政府当时就毫不隐讳地声明，签订这个条约，决不意味着美国不进行地下核试验，不使用、生产、储存、输出和扩散核武器。一年多来的事实，也充分证明了这一点。

一年多来，美国没有停止过在它已经进行的核试验的基础上生产各种核武器。美国还精益求精，在一年多的时间内，进行了几十次地下核试验，使它生产的核武器更趋完备。美国的核潜艇进驻日本，直接威胁着日本人民、中国人民和亚洲各国人民。美国正在通过所谓多边核力量把核武器扩散到西德复仇主义者手中，威胁德意志民主共和国和东欧社会主义国家的安全。美国的潜艇，携带着装

有核弹头的北极星导弹，出没在台湾海峡、北部湾、地中海、太平洋、印度洋、大西洋，到处威胁着爱好和平的国家和一切反抗帝国主义和新老殖民主义的各国人民。在这种情况下，怎么能够由于美国暂时不进行大气层核试验的假象，就认为它对世界人民的核讹诈和威胁不存在了呢？

大家知道，毛泽东主席有一句名言：原子弹是纸老虎。过去我们这样看，现在我们仍然这样看。中国发展核武器不是由于中国相信核武器的万能，要使用核武器。恰恰相反，中国发展核武器，正是为了打破核大国的核垄断，要消灭核武器。

中国政府忠于马克思列宁主义，忠于无产阶级国际主义。我们相信人民。决定战争胜负的是人，而不是任何武器。中国的命运决定于中国人民，世界的命运决定于世界各国人民，而不决定于核武器。中国发展核武器，是为了防御，为了保卫中国人民免受美国发动核战争的威胁。

中国政府郑重宣布，中国在任何时候、任何情况下，都不会首先使用核武器。

中国人民坚决支持全世界一切被压迫民族和被压迫人民的解放斗争。我们深信，各国人民依靠自己的斗争，加上互相支援，是一定可以取得胜利的。中国掌握了核武器，对于斗争中的各国革命人民，是一个巨大的鼓舞，对于保卫世界和平事业，是一个巨大的贡献。在核武器问题上，中国既不会犯冒险主义的错误，也不会犯投降主义的错误。中国人民是可以信赖的。

中国政府完全理解爱好和平的国家和人民要求停止一切核试验的善良愿望。但是，越来越多的国家懂得，核武器越是为美帝国主义及其合伙者所垄断，核战争的危险就越大。他们有，你们没有，他们神气得很。一旦反对他们的人也有了，他们就不那么神气了，核讹诈和核威胁的政策就不那么灵了，全面禁止和彻底销毁核武器的可能性也就增长了。我们衷心希望，核战争将永远不会发生。我们

深信，只要全世界一切爱好和平的国家和人民共同努力，坚持斗争，核战争是可以防止的。

中国政府向世界各国政府郑重建议：召开世界各国首脑会议，讨论全面禁止和彻底销毁核武器问题。作为第一步，各国首脑会议应当达成协议，即拥有核武器的国家和很快可能拥有核武器的国家承担义务，保证不使用核武器，不对无核武器国家使用核武器，不对无核武器区使用核武器，彼此也不使用核武器。

如果已经拥有大量核武器的国家连保证不使用核武器这一点也做不到，怎么能够指望还没有核武器的国家相信他们的和平诚意，而不采取可能和必要的防御措施呢？

中国政府将一如既往，尽一切努力，争取通过国际协商，促进全面禁止和彻底销毁核武器的崇高目标的实现。在这一天没有到来之前，中国政府和中国人民将坚定不移地走自己的路，加强国防，保卫祖国，保卫世界和平。

我们深信，核武器是人制造的，人一定能消灭核武器。

附录 B　中国的核武器试验
（1964 年～1978 年）

次序	日　期	当量(万吨)	试验方式及运载系统	其　它
1	1964.10.16	2	地面(120 米高塔)	裂变，^{235}U
2	1965.5.14	2～4	空投(轰-6 轰炸机)	裂变，^{235}U
3	1966.5.9	20～30	空投(轰-6 轰炸机)	裂变，^{235}U 和一些热核材料(锂-6)
4	1966.10.27	2～2.5	射程＞800 公里的中程弹道导弹(东风-2)	裂变，^{235}U，从双城子发射到罗布泊
5	1966.12.28	30～50	地面(高塔)	裂变，^{235}U 和一些热核材料(锂-6)
6	1967.6.17	300	空投(轰-6 轰炸机)	热核装置，用 ^{235}U、^{238}U、重氢和锂-6，裂变-聚变-裂变型
7	1967.12.24	1.5～2.5	空投(轰 6 轰炸机)	^{235}U、^{238}U 和锂-6，只发生裂变反应
8	1968.12.27	约 300	空投(轰 6 轰炸机)	热核装置，用 ^{235}U、锂及钚
9	1969.9.23	2～2.5	地下	裂变
10	1969.9.29	约 300	空投(轰-6 轰炸机)	热核
11	1970.10.14	约 300	空投(轰-6 轰炸机)	热核
12	1971.11.18	约 2	地面(高塔)	裂变，可能用了钚
13	1972.1.7	＜2	空投(轰-6 轰炸机)	裂变，可能用了钚

次序	日　期	当量(万吨)	试验方式及运载系统	其　它
14	1972.3.18	10～20	空投(轰-6轰炸机)	可能是一种热核弹头的引爆装置(用了钚)
15	1973.6.27	＞200	空投(轰-6轰炸机)	热核
16	1974.6.17	20～100(可能近100)	大气层	热核
17	1975.10.27	＜1	地下	裂变
18	1976.1.23	＜2	大气层	裂变
19	1976.9.26	20	大气层	裂变;有一部分聚变试验失败;特种武器
20	1976.10.17	1～2	地下	裂变
21	1976.11.17	400	空投(轰-6轰炸机)	热核;中国至今当量最大的一次试验
22	1977.9.17	＜2	大气层	裂变
23	1978.3.15	＜2(也许只有0.6)	大气层	裂变
24	1978.10.14	＜2	地下	裂变
25	1978.12.14	＜2	大气层	裂变

附录 C　中国核武器计划的关键人物

（1954 年～1967 年）

国家领导人

本书提到的这个名单列举了中国核计划的主要参加者。我们 1986 年会见的中国人提供了他们掌握的关键科学家名单，其中大多数本书已提到了。中国名单中的一位科学家——张兴钤教授，由于我们未进一步核证，本书未提到。我们补充了中国名单中没有的两位科学家——禄福延和吴征铠。

陈毅

政治局委员、外交部长、副总理；为了提高中国的国际地位，他反复要求政治局优先发展战略武器。

贺龙

政治局委员、中央军委副主席（1959 年至 1967 年）、国防工业委员会主任（1959 年至 1963 年）、副总理、15 人专门委员会成员；他负责武器和军事装备的生产。

罗瑞卿

中央书记处成员（1962 年至 1966 年）、总参谋长（1959 年至 1966）、中央军委秘书长（1959 年至 1966 年）、国防工业办公室主任（1961 年至 1966 年）、15 人专门委员会成员；他负责协调武器和军事装备的研究与生产。

毛泽东

中国共产党中央委员会主席、中央军委主席；他最终决策整个战略武器计划。

聂荣臻

中央军委副主席（自 1959 年起），自 1958 年起任国防科学技术委员会和国家科学技术委员会主任、副总理、15 人专门委员会成员；1958 年以后，他全面领导战略武器计划。

周恩来

政治局常委、总理。参与了发展核武器的最初决策，1962 年 11 月以后，作为 15 人专门委员会主任，为了加速核武器的研究与发展，他积极协调战略武器计划各有关机构。

科 学 家

曹本熹

化学家、第二机械工业部燃料生产局总工程师兼北京核工程研究设计院副院长；他对六氟化铀生产及钚化学分离做出了特殊贡献。

陈能宽

获美国博士学位的物理学家；1960 年以后，在王淦昌的领导下，他负责发展炸药装置，他所领导的小组进行了 1000 多次试验，发现了原子弹引爆原理。

邓稼先

获美国博士学位的物理学家；1960 年后他领导西北核武器研究设计院（九院）的理论设计工作；他对原子弹和氢弹的理论设计工作做出了重大贡献。

郭永怀

获美国博士学位的工程师；九院副院长、九院一个技术委员会的主任；60 年代初，他与工程师龙文光一起对原子弹的结构设计、环

境试验、飞行试验做出重大贡献；在1968年的一次飞机坠毁事故中遇难。

姜圣阶

核化学家；二机部酒泉原子能联合企业总工程师、第一副厂长；在1963年底至1964年春期间，他帮助核部件生产厂解决了有关核部件熔炼、铸造等技术问题。

龙文光

工程师和郭永怀院长助理；在九院设计部任职，帮助工程师们设计原子弹结构；后来他成为设计部主任。

禄福延

主管二机部第六研究所的生产技术；1960年，他领导了氧化铀和四氟化铀试生产。后来他又被调往414厂主管氧化铀的大规模生产。

彭桓武

获英国博士学位的理论物理学家；九院副院长、九院一个技术委员会的主任；60年代，他被指派全面负责原子弹和氢弹的理论设计。

钱晋

副教授，他改进了第一颗原子弹的高爆炸药、电火花引爆装置的制造技术；在“文革”中受迫害致死。

王淦昌

获德国博士学位的物理学家；九院副院长，九院一个技术委员

会的主任；他全面负责原子弹炸药装置和引爆装置的研制与试验。

吴征铠

化学家；复旦大学化学系主任；1960 年被任命为原子能研究所 615 研究部主任；在他的领导下，615A 组完成了兰州气体扩散厂的理论计算，615B 组完成了六氟化铀的试生产。

俞大光

教授。他帮助设计了炸药装置用的全套多线同步点火机构。

于敏

理论物理学家；在邓稼先领导下的九院理论部任副主任，为中国氢弹的理论设计做出了杰出贡献。

周光召

由彭桓武培养的理论物理学家，曾在苏联杜布纳联合原子核研究所接受培训；1960 年以后任九院理论部第一副主任。他曾数次核证了原子弹设计的理论计算；他领导的小组完成了原子弹力学设计的计算工作。

朱光亚

获美国博士学位的物理学家，调到九院后，他被指派主管关于原子弹的科研机构，后又任副院长。他还曾任国防科学技术委员会副主任。

政府官员

郭英会

九院最早的领导干部之一；他协助李觉工作，是九院的行政领

导。

李觉

二机部九局局长、九院院长；在二机部的领导下，他全面负责原子弹计划的研究、发展工作。

刘杰

在50年代中期至60年代中期历任二机部副部长、部长（1960年至1966年），他主管二机部的日常工作；15人专门委员会成员。

刘西尧

历任二机部副部长、部长，第一颗原子弹试验现场指挥部副总指挥；他被指派负责原子弹计划研究发展的管理工作；在他的领导下，氢弹计划取得了迅速发展。

钱三强

获法国博士学位的物理学家；曾任原子能研究所所长、二机部副部长；他主管原子弹计划的科研工作。

宋任穷

第一任主管中国核工业的部长（1956年至1960年）；该部最初称第三机械工业部（1956年至1958年），后改称第二机械工业部。

王介福

兰州气体扩散厂厂长。

吴际霖

九局副局长，九院一个技术委员会的主任。他是李觉的最重要

助手。在“文革”中被迫害致死。

袁成隆

二机部副部长；他主管部里与核武器生产有关的全部工作。1963年至1964年，他在兰州气体扩散厂、核部件生产厂蹲点帮助解决关键技术问题。

张爱萍

副总参谋长；国防科学技术委员会副主任；国防工办副主任；第一颗原子弹试验委员会主任；第一颗原子弹试验现场指挥部总指挥；15人专门委员会成员。

张蕴钰

罗布泊核武器试验基地第一任司令；全面负责历次核试验的准备工作。

赵尔陆

负责武器、军事装备研究与发展工作的重要部长；国防工业办公室副主任，15人专门委员会成员。

祝鳞芳

酒泉核部件生产厂核部件生产车间副主任；他所领导的小组解决了与第一颗原子弹铀芯有关的熔铸、机械加工方面的技术问题。

资料来源说明

要看下面以简略形式引证的著作的作者的名字的全称、题目、发表的数据等，请参见本书后面的“参考文献”部分。在本“资料来源”说明中，对于以下四个频繁引证的刊物或机构的名称作者没有翻译成英文，它们是 *Renmin Ribao*(《人民日报》)、*Xinhua*(新华社)、*Xin Hua Banyuekan*(《新华半月刊》) 和 *Xin Hua Yuebao* (《新华月报》)。在本“说明”中利用了下列缩略语：

FBIS：*Foreign Broadcast Information Service*(外国广播新闻处)；

FRUS：U. S. Department of State, *Foreign Relations of United States* (Washington D. C., vols. for 1949～57) [美国国务院，《美国外交关系》(哥伦比亚特区华盛顿，1949～57 卷)]；

JPRS：Joint Publication Research Service (联合出版物研究处)；

NRH：Nie Rongzhen, *Nie Rongzhen Huiyilu* [聂荣臻，《聂荣臻回忆录》(北京，1984)]

NYT：*New York Times* (《纽约时报》)。

第一章

1. Text as in *Break the Nuclear Monopoly*, pp. 1-5; this text is reproduced in Appendix A.
2. Statement of Sept. 29, 1964, in NYT, Sept. 30, 1964.
3. Text of Oct. 18, 1964, statement in NYT, Oct. 19, 1964.
4. For Zhou's statement, see *Break the Nuclear Monopoly*, pp. 9-10; and on the partial test ban treaty the documents are in *People of the World*.
5. Interview with a senior Chinese military officer, 1983.
6. *Nie Rongzhen Huiyilu*; *Mimi Licheng*. The Magical Sword Branch of the Nuclear Industry Ministry, which edited *Mimi Licheng*, is associated with the Magical Sword Literary and Art Society, inaugurated in August 1983. The society seeks to "promote mass literary and art work on the national defense science and technology and national defense industry fronts." *Xinhua*, Aug. 11, 1983. The society publishes the journal *Shenjian* [Magical Sword].
7. Li Jue et al., chief eds., *Dangdai Zhongguo de He Gongye* [Contemporary China's Nuclear Industry]. This book, part of the Contemporary China series of more than 200 volumes, is the most complete Chinese history to date

of the nuclear weapons program. The four chief editors are Li Jue, Lei Rongtian, Li Yi, and Li Yingxiang.

8. Hewlett and Anderson (U.S.); Rhodes (U.S.); Gowing, *Independence* (U.K.); Goldschmidt (international); Irving, *Virus House* (Germany); a study of the Soviet program, now in preparation by the political scientist David Holloway.

9. In this section, we have profited from reading George, *Presidential Decisionmaking*, especially pp. 1-12.

10. Mao [5], pp. 295-309. For a discussion, see J. Lewis, *Leadership*, Chap. 2.

11. Mao [8], p. 422.

12. For the most serious scholarly assessments of this evidence, see Borg and Heinrichs. The essays in this book by no means reach a consensus on the evidence of the Chinese Communist Party's pre-1950 policy options toward the United States or what conclusions can be reached from that evidence.

13. Mao [8], p. 416.
14. Mao [14], p. 87.
15. Mao [19], pp. 97-101.
16. *Ibid.*, p. 100.
17. Mao [6], p. 181.
18. Mao [8], pp. 415, 416.

19. For the major documents, see *Sino-Soviet Treaty*.

20. Secretary of State to U.S. embassy, Paris, Feb. 11, 1950, in FRUS 1950, 6: 309.

21. Rusk to Acheson ("Memorandum by the Assistant Secretary"), April 26, 1950, in *ibid.*, p. 335.

22. Rusk to Acheson ("Extract from a Draft Memorandum"), May 30, 1950, in *ibid.*, p. 349.

23. For a discussion, see Whiting, *China Crosses the Yalu*; and George and Smoke, Chap. 7.

24. See "Effects of Operations in Korea," NIE-32 (July 10, 1951), in FRUS 1951, 7.2: 1737-43, at p. 1742.

25. Quoted in Peng Dehuai, p. 472.

26. *Ibid.*, pp. 473-74; Li Jukui, p. 44.

27. Peng Dehuai, p. 473.

28. Mao [10], p. 43; "Why We Must Participate."

29. "Effects of Operations in Korea," in FRUS 1951, 7.2: 1741.

30. *Ibid.*, pp. 1741-42.
31. *Seven Letters*, p. 25.
32. Mao [11], pp. 116-18.
33. "Two Different Lines."

34. George, *Chinese Communist Army*, p. 199.

35. *Ibid.*, p. 200; Whitson, p. 95.

36. George, *Chinese Communist Army*, pp. 171-75.

37. Whitson, p. 95. Several sources have assumed that Lin Biao served as the first CPV commander and was replaced by Peng in 1951. This seems not to be the case, as indicated by Peng's memoirs. For a discussion of this issue, see Farrar-Hockley, especially p. 292.

38. Whitson, pp. 95, 98. The Military Academy (Junshi xueyuan) was established on January 15, 1951.

39. "Courses of Action Relative to Communist China and Korea," March 14, 1951, in FRUS 1951, 7.2: 1598-1605; "Vulnerabilities of Communist China," May 22, 1951, in *ibid.*, pp. 1673-82.

40. Kennan to Acheson, June 20, 1951, in *ibid.*, 7.1: 537.

第二章

1. Chu Chi-hsin, p. 6.
2. Interviews with Chinese specialists, 1986.
3. For a brief discussion, see Blacker and Duffy, p. 158.
4. See Eisenhower, *White House Years*, pp. 72-73, 93-97.
5. NYT, Dec. 6, 1952.
6. NYT, Dec. 24, 1952.
7. NYT, Dec. 15, 1952.
8. For a scholarly examination of what Eisenhower actually said and did at the time, see Keefer, pp. 267-89.
9. Eisenhower, *White House Years*, Chap. 7. White House document NSC 147, dated April 2, 1953, gave the most complete review of options toward Korea. Entitled "Analysis of Possible Courses of Action in Korea," it examined, among other things, the pros and cons of using atomic weapons to end the war. The full text is in FRUS 1952-54, 15.1: 839-57. See especially pp. 845-46. See also "Communist Capabilities and Probable Courses of Action in Korea," NIE-80 (April 3, 1953), in *ibid.*, pp. 865-77.
10. Eisenhower, *White House Years*, p. 181.
11. Adams, p. 48.
12. For a discussion of the sources on this strange event, see Keefer, especially pp. 280-81.
13. *Guangming Ribao* [Bright Daily], Jan. 23, 1953.
14. The principal source for the Chinese views in this paragraph is Jiang Zhenghao, "Some Aspects." Unless otherwise noted, the quorations in this and the next two paragraphs are from this paper, which is quoted with Mr. Jiang's permission. Mr. Jiang served on the Chinese delegation at the Panmunjom armistice talks and later in various diplomatic posts.
15. For a careful review of the controversy over the repatriation of prisoners, see Bernstein.
16. Conversations with Chinese specialists, 1984-85.
17. In addition to Jiang Zhenghao, "Some Aspects," this paragraph is based on conversations with Chinese specialists, 1984-85. Mao Zedong's review of how "we have won a great victory in the war to resist U.S. aggression and aid Korea" is in Mao [11], pp. 115-20.
18. See "Communist Capabilities," in FRUS 1952-54, 15.1: 865, which notes: "A highly organized, well-integrated defensive zone extends possibly 15 to 20 miles to the rear of present battle positions. Many fortified areas have been constructed in rear of this zone and are being improved and expanded."
19. Eisenhower, *White House Years*, p. 181. For a text of the letter of Feb. 22, 1953, see FRUS 1952-54, 15.1: 788-89. In a letter to the Department of the Army, General Mark Clark noted that he had a "serious doubt that the Communists would agree to any such proposal." *Ibid.*, p. 789.
20. See "Marshal Kim Il Sung," p. 7. On March 30, 1953, the New China News Agency broadcast a statement by Premier Zhou Enlai proposing that negotiations should begin immediately on the exchange of sick and wounded, followed by an overall settlement of the prisoner-of-war question. For the text, see *People's China*, No. 8 (April 16, 1953), pp. 5-7, and Department of State *Bulletin*, 28.720 (April 13, 1953), pp. 526-27.

21. American views of the Korean Armistice negotiations have been fully documented in many sources. See especially FRUS *1952-54*, 15.1 and 15.2: 938-1445; Eisenhower, *White House Years*, Chap. 7; Clark, especially Chaps. 16-18; Goodman; Hermes; Joy; Rees; and Ridgway, *Korean War*.

22. From 1949 on, the Chinese prepared two daily compilations of translated Western news articles, *Cankao Ziliao* [Reference Materials] and *Cankao Xiaoxi* [Reference News]. The first of these is distributed to senior cadres and the second to both senior and junior cadres. Both are widely available. For a review of some issues of *Cankao Xiaoxi*, see Schwarz.

23. See FRUS *1952-54*, 2.1: *passim*.

24. For the principal sources on the New Look, see Eisenhower, *White House Years*, Chap. 18; FRUS *1952-54*, 2.1; Jurika, especially pp. 319-27; and Kinnard, Chap. 1.

25. NYT, May 1, 1953. At this time, presidential press conferences did not allow direct quotations, so this quotation, like others from such meetings in this period, is a paraphrase. The transcripts of Eisenhower's press conferences have now been published; we have chosen to use the contemporary newspaper paraphrases because these are what the Chinese would have read.

26. Eisenhower publicly commented on the new policy about the time the new basic strategy was approved. In October 1953, amid speculation about Soviet thermonuclear weapons ("super bombs"), the president emphasized the strength of the American arsenal and called for a major buildup of U.S. air forces. NYT, Oct. 9, 1953. Military analyst Hanson Baldwin reviewed the New Look two days after the policy was adopted and a week later discussed the growing nuclear arms race and the increased stress on the use of atomic weapons. NYT, Nov. 1 and 8, 1953. Brief references to changes in American strategic thinking continued to appear in the American and European press throughout the first nine months of 1954.

27. The documents leading up to and including NSC 162/2 are found in FRUS *1952-54*, 2.1. The text of NSC 162/2 is at pp. 577-97.

28. *Ibid.*, p. 593. This sentence was the source of differences of interpretation between officials at the departments of State and Defense. See "Memorandum by the Undersecretary," Dec. 3, 1953, in *ibid.*, pp. 607-8.

29. Text in *ibid.*, p. 597.

30. Memorandum of NSC discussion, Aug. 27, 1953, in *ibid.*, p. 445.

31. *Ibid.*, p. 447.

32. NYT, Dec. 15, 1953.

33. NYT, Jan. 8, 1954.

34. For the text of the speech, see NYT, Jan. 13, 1954. Dulles subsequently discussed his "strategy to deter aggression." See Dulles, "Policy," pp. 357-59.

35. "Eisenhower Clamors for Preparations." See also "Dulles Has the Nerve"; Wu Quan, "New Look"; and "United States Is Afraid."

36. This is based on Rosenberg, "Origins." For typical press comments on these new deployments, see NYT, Sept. 6, 1953.

37. Rosenberg, "Origins," pp. 27-28.

38. *Ibid.*, p. 31.

39. In addition to the sources cited in note 35, see Wu Quan, "Comprehensive Foreign Policy"; and Jiang Nan, "Indian Prime Minister." Jiang Nan paid special attention to Nehru's statement that the U.S. policy of massive retaliation "included possible attack on the China mainland."

40. See, for example, Eisenhower's comments in NYT, Jan. 6, 1954, and his commitment in the State of the Union message to "continue military and economic aid to the Nationalist Government of China" (Taiwan); NYT, Jan. 8, 1954. On April 5, Dulles issued a direct warning to Beijing against further assistance to the Vietminh in Vietnam and suggested the Chinese threat might extend beyond Southeast Asia to engulf Australia and New Zealand. NYT, April 6, 1954.

41. Rosenberg, "Smoking," p. 27.

42. "Summary Statement," Oct. 11, 1954, in FRUS 1952-54, 2.1: 750.

43. NYT, March 30, 1954.

44. Text in FRUS 1952-54, 14.1: 278-306.

45. Documents of the Korean phase of the Geneva Conference are in FRUS 1952-54, 16: 3-394. For a discussion of the Indochina phase of the conference, see Kahin and Lewis, Chap. 3.

46. These messages are reproduced in FRUS 1952-54, 16: 14-142.

47. At the request of the Korean government, Rhee's letter of March 11 was not declassified and has not been released. *Ibid.*, pp. 14, 35-36.

48. The text of the letter is in *ibid.*, p. 44.

49. See, for example, "Communique of the Delegations," p. 7; "Welcome the Delegation"; and Jiang Nan, "New China News Agency."

50. U.S. ambassador, Seoul, to Department of State, May 11, 1954, in FRUS 1952-54, 16: 245.

51. NYT, Dec. 27, 1953. This reflected a top-secret memo of Nov. 11, 1953; see FRUS 1952-54, 2.1: 597.

52. NYT, Dec. 15, 1953, Jan. 13, 1954.

53. NYT, Dec. 26, 1953.

54. NYT, Feb. 24, 1954.

55. NYT, Feb. 8, 1955; FRUS 1952-54, 14.1: 157 (March 19, 1953), 14.1: 333 (Nov. 18, 1953). Citing unpublished memoirs by Wellington Koo, Taiwan's ambassador to the United States, Thomas E. Stolper says the idea of a mutual defense pact was first suggested to Washington in March 1953. On the treaty's background, see Stolper, pp. 21-26.

56. Rankin, pp. 189, 190. These quotes appear in an entire chapter devoted to the treaty, pp. 171-214.

57. For these early PRC reactions, see "Thoroughgoing Betrayal." According to this source, Beijing first picked up hints of discussions of a U.S.-Taiwan mutual security pact from Nixon's visit to Taiwan in late 1953. This is consistent with Dulles's later testimony.

58. For examples, see FRUS 1952-54, 14.1: 344, 367-70, and 399-401. Most public discussion of these recommendations focused on a Southeast Asia treaty. See NYT, April 6 and 11, May 13 and 14, and June 10, 1954. By June, the American press was referring to a U.S.-Taiwan mutual security treaty as essentially a fait accompli. This was based on a report from a Taipei newspaper that the two governments had agreed tentatively on such a pact. NYT, June 30, 1954.

59. See Jurika, Chap. 27, especially p. 422.

60. Rankin, p. 194.

61. FRUS 1952-54, 14.1: 345-401 *passim*.

62. Rankin, pp. 194-95; NYT, June 20, 1954; Stolper, pp. 25-26.

63. Rankin, pp. 197-98.

64. Jurika, pp. 425-27.

65. *Ibid.*; "Memorandum by the Counselor," April 7, 1954, in FRUS 1952-54, 13: 1271, in which the admiral advised that "three tactical A-weapons, properly employed, would be sufficient to smash the Viet effort there [at Dienbienphu]." On China, see FRUS 1952-54, 12.1: 512-13, 521-26, and 556.

66. See, for example, NYT, Feb. 24, June 30, and July 22, 1954.

67. For an excellent discussion of this crisis and its aftermath, see Stolper, Chaps. 3 and 4. Because our interpretation of the crisis emphasizes military questions as they bear on the subsequent Chinese nuclear decision, it differs slightly from Stolper's.

68. Eisenhower, *White House Years*, p. 459. NYT, Sept. 4, 1954, carries the first news of this attack. The administration's first public reaction, which was reserved, came on September 5 (NYT, Sept. 6, 1954). On September 8, Washington announced that the PRC intended to attack Quemoy (NYT, Sept. 9, 1954), and the next day, Dulles met with Chiang Kai-shek in Taipei and promised the Nationalists they did not "stand alone" (NYT, Sept. 10, 1954).

69. One of the authors was an officer in the U.S. Pacific Fleet at this time. For public statements on the alert, see NYT, Sept. 5 and 6, 1954.

70. Eisenhower, *White House Years*, pp. 462, 459.

71. U.S. Senate, p. 313.

72. "United States Objectives," NSC 146/2 (Nov. 6, 1953), in FRUS 1952-54, 14.1: 307.

73. Chinese news stories on these attacks are in *Renmin Ribao*, Dec. 24, 1953, and May 20, 1954. See also *Xin Hua Yuebao*, Dec. 28, 1954, p. 116; and *Renmin Ribao*, July 16, 1954.

74. *Xin Hua Yuebao*, Aug. 28, 1954, p. 93.

75. *Renmin Ribao*, July 16, 1954. See also Ho Cheng, who details the attacks on merchant shipping by Taiwan's forces.

76. NYT, July 24-28, 1954; *Xin Hua Yuebao*, Aug. 28, 1954, p. 51.

77. The two *Renmin Ribao* articles appeared on successive days—July 23 and 24, 1954. See also Zhu De.

78. NYT, Aug. 4, 1954.

79. NYT, Aug. 10, 1954.

80. Zhou Enlai, "Report on Foreign Affairs," especially pp. 121-26.

81. NYT, Aug. 18, 1954.

82. Khrushchev 1974, p. 246. The trip is covered in pp. 245-50.

83. Text in *People's China*, No. 21 (Nov. 1, 1954), supplement, p. 5.

84. Khrushchev 1970, p. 466.

85. *Xin Hua Yuebao*, Dec. 28, 1954, pp. 9-13.

86. For a discussion of deterrence in respect to the Taiwan Strait crisis of 1954-55, see George and Smoke, Chap. 9.

87. Interviews with Chinese specialists associated with the crisis, 1984. For a published assessment by a senior Chinese military commander involved in the crisis, see Nie Fengzhi et al., pp. 39-57 *passim*. See also He Di, "The Evolution of the People's Republic of China's Policy Toward the Offshore Islands (Quemoy, Matsu)," Sept. 1987; cited by permission of the author.

88. Gittings, p. 197.

89. Jiang Zhenghao, "Sovereignty." This paper is cited with Mr. Jiang's permission.

90. U.S. delegation, Geneva, to Department of State, June 26, 1954, in FRUS *1952-54*, 16: 1251; Sixth Plenary Session, June 9, 1954, in *ibid.*, p. 1090.

91. For the text of Zhou's statement, see *People's China*, No. 15 (Aug. 1, 1954), supplement, p. 6.

92. Zhou Enlai, "Report on Foreign Affairs," pp. 110-11, 118. Zhou added that his "proposition" did "not envisage the exclusion of any country" (p. 118).

93. *Ibid.*, pp. 121, 126.

94. Mao [7], p. 56.

95. Zhou Enlai, "Report on Foreign Affairs," pp. 111, 125-26.

96. Rankin, p. 205.

97. Ridgway, *Soldier*, pp. 278-79.

98. Eisenhower, *White House Years*, pp. 462, 465, 466; U.S. Senate, p. 164.

99. SNIE-100-4-54 (Sept. 4, 1954), in FRUS 1952-54, 14.1: 563-71.

100. NIE-43-54 (Sept. 14, 1954), in *ibid.*, especially pp. 627-45.

101. Eisenhower, *White House Years*, p. 465.

102. *Ibid.*, pp. 466, 467. One of the authors served on a destroyer that assisted in the evacuation of the Dachen Islands. In briefings by senior officers of the task force, ship captains (as consistent with SNIE-100-4-54 cited in note 99) were told that the Dachens were critical to the early warning defense against air raids coming from China's airfields to northwest of Taiwan. They felt that Quemoy and Matsu had no such value because of their location in relation to major Chinese airfields. For a similar judgment by authorities on Taiwan, see "Memorandum of a Conversation," Jan. 19, 1955, in FRUS *1955-57*, 2: 40. In this conversation, for example, Taiwan's foreign minister called the Dachens "extremely useful for radar tracking and intelligence operations." For a Chinese view of this action, see *Disaster Strikes the Tachens*; and *Xin Hua Yuebao*, May 28, 1955, p. 60.

103. We have not given much attention to the actual negotiation of the Mutual Defense Treaty between the United States and the Republic of China; the text is in *American Foreign Policy, 1950-1955*, pp. 945-47. For a lucid discussion of the treaty and relevant subsequent events, see Stolper, Chaps. 4 and 5.

104. "Summary Statement," in FRUS *1952-54*, 2.1: 743, 747.

105. "Basic National Security Policy," Nov. 15, 1954, in FRUS *1952-54*, 2.1: 772. This document is a revision of NSC 162/2.

106. "Basic National Security Policy," Dec. 14, 1954, in *ibid.*, p. 811.

107. NYT, Jan. 3, 1955.

108. Guo Moruo, "Strengthen the Peace Forces," p. 5.

109. Jiang Nan, "People."

110. Eisenhower, *White House Years*, p. 467. At an NSC meeting on Jan. 20, 1955, the president said, "It was not that any of these offshore islands was going to be easy to defend, but that the psychological consequences of abandoning these islands were so serious. . . . We must now be concerned with the morale of those soldiers who might well be called upon to defend Formosa." "Memorandum," in FRUS 1955-57, 2: 79-80.

111. The text of the Formosa Resolution ("Joint Resolution by the Con-

gress," Jan. 29, 1955) is in FRUS *1955-57*, 2: 162-63; and NYT, Jan. 29, 1955.

112. See Halperin and Tsou, p. 125. For the relevant documents on the defense of Quemoy and Matsu, see FRUS *1955-57*, 2: 46-48, 50-52, 75-77, 79, 101, 145, 166-68, 174-75, and 181-82. The president's statement on not being "hooked" is on p. 175. On January 31, however, Ambassador Rankin in Taipei reported that Taiwan's foreign minister had mentioned "several times and quite definitely a firm agreement that [the] two governments would issue coordinated statements including specific reference to US protection for Kinmen [Quemoy] and Matsu" (p. 181).

113. Eisenhower, *White House Years*, p. 467. For a more general discussion of this point, see George and Smoke, pp. 286-88.

114. U.S. Senate, pp. 16, 68.

115. *Ibid.*, pp. 68, 74-75, 130. See also p. 71.

116. *Ibid.*, pp. 149, 162-65, 312.

117. Halperin and Tsou, p. 137.

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1. This assessment is based on J. Lewis, "China's Military Doctrines," pp. 148-50.

2. *People of the World*, pp. 22, 85.

3. This paragraph is based on Li Jue et al., pp. 4, 9. Mao's quotation of June 21, 1958, is from Su Fangxue, p. 4; and Su Kuoshan. Mao echoed his 1958 quote in 1960 when he said: "We should pay attention to the policy of strength and the position of strength." All states, he insisted, "give the highest priority to building their strength." Liu Suinian, p. 23.

4. Mao [3], pp. 152, 153.

5. See Eisenhower, *White House Years*, Chap. 19. The quote is from U.S. Senate, p. 65.

6. For the text of the Formosa Resolution, see NYT, Jan. 29, 1955.

7. Tan Wenrui; *Xinhua*, Jan. 24, 1955, in *Survey of China Mainland Press*, No. 974 (Jan. 22-26, 1955), p. 2.

8. "Resolutely Oppose."

9. This paragraph is based on Li Jue et al., p. 13; and Qian Sanqiang, "Cherish the Memory."

10. Li Jue et al., p. 13; Zhang Jiong, p. 108.

11. Mao [4], pp. 23, 24, 36. Italics in the original are omitted.

12. Cited in Schram, p. 229. For an analysis of Sakata's ideas and Mao's views on contradictions, see Wakeman, p. 227. Sakata's article is listed in the References.

13. Quoted in Schram, p. 251.

14. This and the next two paragraphs are based on Li Jue et al., pp. 14, 21; and Qian Sanqiang, "Cherish the Memory."

15. Mao [16], p. 168.

16. The pioneer work on China's nuclear strategy in this period is Hsieh, *Communist China's Strategy*; see especially Chap. 2. Hsieh writes (p. 26): "In contrast to 1954, . . . there was, for several months after January 1955, an unprecedented volume of comment on nuclear matters." On Soviet doctrines, see Holloway, *Soviet Union*, pp. 35-39. See also Dinerstein, Chap. 2.

17. Eisenhower, *White House Years*, p. 476. This statement to the president was not made public. See NYT, March 8, 1955.

18. See Dulles, "Report," pp. 459-60 (where he says he threatened the use of "new and powerful weapons of precision which can utterly destroy military targets without endangering unrelated civilian centers"); and Eisenhower, *White House Years*, p. 477.

19. Eisenhower, *White House Years*, p. 477. For the Chinese reaction, see "Eisenhower Advocates Use." On March 29, *Renmin Ribao* stated that the United States was threatening China with massive retaliation, and that China needed to be ready to cope with sudden emergencies. See "Make Great Efforts."

20. Guo Moruo, "Ban Atomic Weapons!," p. 3. Many pamphlets appeared in 1955 to educate the populace on the dangers of nuclear weapons and to mobilize them against nuclear war. See, for example, Wang Zhiliang.

21. Interviews with Chinese specialists, 1986.

22. "Statement of Soviet Government," p. 53. The text of the Chinese State Council resolution on this offer is in *People's China*, No. 4, Feb. 16, 1955, supplement.

23. See Liu Wei. The reactor is a deuterium-moderated heavy-water reactor; its original power of 7 megawatts was upgraded in the 1960s to 10 megawatts; and it uses 1.2% enriched fuel rods. A later, swimming-pool reactor designed by the Institute of Atomic Energy used 10% enriched material and had a total U^{235} inventory of 5 kg in the mid-1970s. The cyclotron of 1.2-m pole diameter was also later upgraded to a sector-focused variable-energy cyclotron. See Panofsky, pp. 40-43; and Tao Cun.

24. "Resolution of State Council," p. 53.

25. This information on the Soviet role in China's search for and use of uranium is based on Li Jue et al., pp. 20, 138, 168.

26. Lindbeck, p. 10.

27. Guo Moruo, "Strengthen the Peace Forces," p. 5.

28. Li Jue et al., p. 5; Qian Sanqiang, "Peaceful Utilization." See also Qian Weichang. Among the group of physicists in 1949 were Wu Youxun, Peng Huanwu, Wang Ganchang, Qian Sanqiang, He Zehui, Li Shounan, and Zhao Zhongyao.

29. The returned Chinese included Li Siguang (an eminent geologist), Hua Luogeng (an outstanding mathematician), Zhao Zhongyao (who had done major work on radiation), and many others who were to become prominent in the academy.

30. "Survey of the Chinese Academy of Sciences," p. 923; Li Jue et al., p. 6.

31. In 1950, Premier Zhou Enlai created the "Experts Work Group," headed by Wu Xiuquan, and approved a document on methods for strengthening the work of these foreign experts. Yang and Wu.

32. The Institute of Modern Physics was renamed three times. On Oct. 6, 1953, it became the Institute of Physics; on July 1, 1958, the Institute of Atomic Energy; and at the end of 1984, the Chinese Academy of Atomic Energy Science. Li Jue et al., pp. 363, 559. Typical annual reports on the work of the academy are Guo Moruo, "Summary," pp. 184-85; and Guo Moruo, "Report on the Present Status," p. 197. One source lists the nuclear scientists assigned to the institute that "later became the research center of China's nuclear physics." They were (in the order given) Peng Huanwu, Wang Ganchang,

Zhao Zhongyao, Yang Chengzhong, Yang Chengzong, Zhu Hongyuan, Xiao Jian, Deng Jiaxian, Dai Zhuanzeng, Jin Xingnan, Li Shounan, Xin Xianjie, Huang Zuqia, Lu Zuyin, Yu Min, Xu Jianming, Ye Minghan, Zhu Guangya, and Hu Ning. Zhang Jiong, p. 106.

33. "Report by Delegation," p. 209.

34. Qian Sanqiang, "Survey."

35. Unless otherwise noted, this history is based on Qian Weichang, "Physics in China," *Renmin Ribao*, Aug. 13, 1949; Li Jue et al., pp. 5, 6, 8; and T. Y. Wu, pp. 631-43.

36. Feng and Chen.

37. For a short biography of Qian Sanqiang, see Klein and Clark, 1: 188-90.

38. For background on Zhou Guangzhao, see Gu Mainan, "One Out of a Hundred Thousand." A capsule history of his career is given in Appendix C.

39. "To Study Soviet Theory." Materials for the study of Soviet Communist Party history, documents of the Nineteenth Congress of the Soviet Party, and a volume on the Soviet socialist economy were prepared for cadre study. For a sample, see *Xuexi* [Study], 1953, Nos. 1-12. A discussion of cadre study campaigns is in J. Lewis, *Leadership*, pp. 145-56.

40. "Directive," p. 200.

41. Guo Moruo, "Report on the Academy's Basic Situation."

42. "Devote Major Efforts." The agreement was signed on April 29.

43. Qian Weichang was a senior rocket engineer who had completed advanced study in the United States. See *Renmin Ribao*, May 17, 1957; "Rightist Qian Weichang"; Theodore Chen, p. 209; and "All-China Scientific Association."

44. Zhou Enlai, *Report on Intellectuals*, especially pp. 34-35.

45. Theodore Chen, p. 161.

46. NRH, p. 777.

47. Information in this and the following paragraph is from Li Yingxiang et al.

48. Liu Jie; Li Jue et al., pp. 15-16, 561.

49. For an important discussion of Chen Yun's life and views (though not his role in the nuclear program), see Bachman.

50. NRH, pp. 711, 715. Nie's memoirs do not mention the Three-Member Group.

51. For Bo Yibo's biography, see Klein and Clark, 2: 738-42.

52. Li Jue et al., pp. 15-16; Liu Jie. On the creation of the Third Office, see "Order of the State Council."

53. Most of the information in this paragraph is from Li Jue et al., pp. 15-16, 475; and Liu Wei.

54. "Li Peng Makes a Speech"; Li Jue et al., pp. 20-21.

55. Some sources state that the Third Ministry was established in April 1955 and abolished in May 1956. However, the Third Ministry of that period was responsible not for the nuclear industry but for the electrical industry; when formally abolished, it was replaced by the Ministry of Electrical Machine Industry. The new Third Ministry in charge of the nuclear industry was created on Nov. 16, 1956 (see *Xinhua*, Nov. 17, 1956; Li Jue et al., p. 16.) The State Council appointed Song Renqiong the minister and the following vice-ministers: Liu Jie, Yuan Chenglong, Liu Wei, Lei Rongtian, and Qian

Sanqiang. Some information in this and the following paragraph is from interviews with Chinese specialists, 1985-86.

56. *Xin Hua Yuebao*, Sept. 25, 1952, p. 14. The original Second Ministry, created on Aug. 7, 1952, followed a tortuous institutional path to the present Ministry of Ordnance Industry, so named in May 1982. The State Council merged it and the Ministry of Electrical Machine Building with the First Ministry of Machine Building in 1958, and then reestablished it as the Third Ministry in September 1960.

57. Duan Junyi et al.

58. Song Renqiong's biography is in Klein and Clark, 2: 787-90. The way Song's network of contacts functioned will be discussed in Chap. 5.

59. Zhou Enlai, *Report on Intellectuals*, p. 38.

60. Guo Moruo, "Comprehensive Plan," p. 139.

61. Nie Rongzhen, "Development," pp. 334-35.

62. Specifically, the Central Military Commission ordered Deputy Chief of the General Staff Zhang Aiping to head the Equipment Planning Department of the General Staff and to assume leadership of planning scientific research for conventional weapons. Zhang's biography is in Klein and Clark, 1: 9-11. A corps-level commander at the end of the revolutionary war, Zhang rose to commander and political commissar of the East China Sea Fleet. He became deputy chief of the General Staff in 1954. In the 1960s, as we shall see, he commanded various aspects of the nuclear test program.

63. The origins and development of the missile program will be the subject of our subsequent study. References to this program will thus be minimal here.

64. Zhang Aiping, "Several Questions," p. 85.

65. Nie Rongzhen, "Congratulatory Letter"; "Ten Prominent Scientists," p. 28.

66. At this time, Huang Kecheng served as head of the PLA's General Logistics Department.

67. We have no adequate biography of An Dong, who served as Nie's administrator in a number of organizations; in the early 1950s, he had been office director of the General Staff while Nie was its acting chief. In his memoirs, Nie has high praise for An Dong (see, for example, NRH, p. 713), who was "cool-headed" and could deal with problems "in a systematic way." In the mid-1960s, An was implicated in the case against the then-chief of the General Staff, Luo Ruiqing; he committed suicide after Luo was purged.

68. NRH, p. 762; Dong Kegong et al. At the Eighth Party Congress in September 1956, Deng's title was changed from secretary general to general secretary.

69. NRH, p. 770.

70. "Appointments of Nie Rongzhen and Bo Yibo"; NRH, pp. 762-63; "Report by Chinese Academy." On May 12, 1957, the State Council approved the formal establishment of the Scientific Planning Commission and confirmed Nie Rongzhen's appointment as director. On May 23, Guo Moruo, president of the Chinese Academy of Sciences and a commission deputy director, told an academy meeting that the commission had been made a "standing organization" of the State Council and would coordinate the activities of "numerous departments relating to scientific programs." *Renmin Ribao*, May 31, 1957.

71. NRH, pp. 770, 773-74, 793-95; Li Jue et al., p. 16. Nie's efforts to

train and mobilize a force of defense scientists and engineers are discussed in Chap. 5, below.

72. In May 1958, the Central Military Commission established the Fifth Department, which quickly acquired de facto control of the Aviation Industrial Commission and the Division for Scientific Research of the General Staff's Equipment Planning Department. NRH, p. 783.

73. NRH, p. 774.

74. Nie Rongzhen, "Development," p. 337.

75. *Ibid.*, p. 339.

76. Interview with Chinese specialists, 1985.

77. When Song Renqiong was appointed to head the ministry in November 1956, Mao specifically charged him with ensuring coordination and cooperation among the various organizations for the development of nuclear weapons. NRH, pp. 788-89.

78. Li Yingxiang et al.

79. Dai and Zhao; Li Jue et al., p. 189.

80. Most of the information in this and the next paragraph is from NRH, p. 777.

81. Interviews with a Chinese specialist, 1984-85. We shall examine the fate of the military aircraft industry in our later study of the strategic missile program.

82. NRH, p. 782.

83. NRH, p. 783. Not to be confused with the Fifth Academy, the Fifth Department administered the Aviation Industrial Commission and key aspects of the conventional military equipment program.

84. For the biographies of Chen Geng, Liu Yalou, and Wan Yi, respectively, see Klein and Clark, 1: 113-16, 1: 632-34, and 2: 886-87. An outstanding military leader in the revolution, Chen Geng served as deputy commander of the Chinese People's Volunteers under Peng Dehuai in Korea. In the mid-1950s, he became deputy chief of the General Staff and was, for a time (1956-57), acting chief. When he joined the new commission, Chen also became president of the Harbin Military Engineering Institute, which Nie ordered to train research and design personnel for military equipment, "including guided missiles and atomic weapons" (NRH, p. 796). Chen died in 1961. Liu Yalou was a veteran revolutionary political commissar and military commander who had served as Lin Biao's chief of staff. He commanded the PLA air force from 1949 to his death in 1965. Wan Yi also brought to the commission a background as a military commander under Lin Biao in the revolutionary period. He had served as deputy minister of the Second Ministry of Machine Building under Zhao Erlu and, in 1957, became a key member of the Scientific Planning Commission. In 1958, he also headed the PLA's Equipment Planning Department. On An Dong, see note 67, above.

85. The Central Military Commission formally established this academy in October 1956. It was reorganized into the Seventh Ministry of Machine Building in January 1965.

86. The information on the organs listed in Figs. 1 and 2 is based largely on interviews with Chinese specialists, 1986; and Li Jue et al., pp. 26, 33, 41, 257, 418, 436-37, 442.

87. These massive proceedings, published in 33 volumes, are U.N. docu-

ment A/CONF.15/1. They cover technical details of raw material resources, the production of nuclear material, basic metallurgy, reactor technology, and basic and applied nuclear physics.

88. Khrushchev 1970, Chap. 18; Khrushchev 1974, Chap. 2.

89. Khrushchev 1970, pp. 462-63.

90. *Ibid.*, pp. 465, 466.

91. *Ibid.*, pp. 467, 470. In an interview in 1946, Mao said: "The atom bomb is a paper tiger which the U.S. reactionaries use to scare people. It looks terrible, but in fact it isn't. Of course, the atom bomb is a weapon of mass slaughter, but the outcome of a war is decided by the people, not by one or two new types of weapon. All reactionaries are paper tigers." Mao [19], p. 100. These ideas were resurrected at the time of the 1958 Taiwan Strait crisis. For a relevant collection of documents, see *Imperialism and All Reactionaries Are Paper Tigers*, especially pp. 3-33.

92. "Two Different Lines."

93. Khrushchev 1974, pp. 268-69.

94. Conversation with a senior Soviet specialist, 1986.

95. Gu Mainan, "Deng Jiaxian, Veteran Scientist"; information from Chinese specialists, 1986; Li Jue et al., p. 32.

96. Khrushchev 1974, p. 269.

97. This and the next paragraph are based on Li Jue et al., pp. 20-22; and NRH, pp. 800-801. The unofficial Soviet pledge of full-scale assistance was given by a delegation of Soviet atomic energy scientists visiting China.

98. NRH, p. 803.

99. The information on the uranium part of the agreement is from an interview with a Chinese specialist, 1986; and Li Jue et al., p. 43. On the nuclear submarine, see Li Jue et al., p. 32.

100. NRH, pp. 803-4.

101. Ford, pp. 160-73.

102. See especially Borisov, pp. 45-50. "Borisov" is the pseudonym of Oleg Borisovich Rakhmanin, a senior staff official on the Central Committee of the Soviet Communist Party.

103. Khrushchev 1974, p. 258. The Soviet government first made this request to build a long-wave radio station in April 1958; He Xiaolu, p. 171. He Xiaolu notes that at the time the Chinese believed that with such a station the Soviets would "control our intelligence information and secret communications."

104. Khrushchev 1974, pp. 261-63. For a Western interpretation of the effect of the Taiwan Strait crisis on the dispute, see Ford, pp. 168-71.

105. Interview with a Chinese specialist, 1985.

106. NRH, p. 804. Nie does not identify the types of specialists. The information on the two nuclear weapons specialists is from an interview with a Chinese specialist, 1986. On the arrival of the technical specialists and the August 1958 accord, see Li Jue et al., pp. 22, 218.

107. NRH, p. 804. Soviet authors assert that Mao himself first raised the proposal for a joint fleet as "an act of provocation." See Borisov, pp. 69-70.

108. Communication from Nie Rongzhen to the authors, Feb. 15, 1986.

109. Whiting, "Quemoy," pp. 263-70. Mao's quotations in this paragraph are from Whiting's article.

110. He Xiaolu, p. 162.

111. In July 1963, the Chinese denounced the limited test ban treaty signed by the United States, Great Britain, and the Soviet Union. See *People of the World*, especially pp. 1-6.

112. Unless otherwise noted, the information in this paragraph is from NRH, pp. 804-5; and "Riddle of Research and Development," p. 5. For a general idea of the state of negotiations on a test ban in these years, see Blacker and Duffy, pp. 102-9, 126-29.

113. "Statement by the Spokesman of the Chinese Government" (Aug. 15, 1963), in *People of the World*, pp. 28-29. The following month, the Chinese repeated the charge in "Origin and Development," adding that the gift to Eisenhower was intended to "create the so-called 'spirit of Camp David.'"

114. Li Jue et al., p. 565.

115. Mao [1], pp. 517-18; Mao [21], pp. 308-11.

116. Mao [16], p. 168.

117. In articles in the 1960s, this line about strategy and tactics was linked to Mao's ideas on people's war. In December 1936, he had said: "Our strategy is 'pit one against ten' and our tactics are 'pit ten against one.'" Mao [12], p. 135. On the linkage of this statement to the new strategy, see Li Tso-peng.

118. Mao [21], p. 310.

119. Holloway, *Soviet Union*, especially pp. 29-43; the quote is from p. 29.

120. Dinerstein, p. 10.

121. Quoted in Holloway, *Soviet Union*, p. 32.

122. Khrushchev 1974, p. 255.

123. Mao speech, Moscow, November 1957, quoted in "Statement by the Spokesman of the Chinese Government" (Sept. 1, 1963), in *People of the World*, p. 42.

124. The account of the Mao-Khrushchev conversation in this paragraph and the two that follow are based on Khrushchev 1974, pp. 256-57.

125. Mao [2], pp. 494-95.

126. Quoted in "Comrade Mao Zedong."

127. Mao [13], pp. 108-9.

128. "Greet the Upsurge," p. 15. In a speech on September 5, Mao said that if the enemy "is determined to fight, it is they who will strike first, and it is they who will strike with atomic bombs. . . . If we have to fight, then we'll fight, and after we've fought, we'll rebuild. For this reason we must now build up the militia. The militia must be developed in every people's commune." Mao [17], p. 88. Mao's stress on the militia accorded with his general views on the validity of people's war to defeat all enemies, however well armed.

129. Mao [13], p. 108.

130. Mao [20], pp. 136-37. Some years later, the Chinese Institute of Literature issued *Stories About Not Being Afraid of Ghosts* (Beijing, 1961) to taunt the Soviets for their alleged ghosts of nuclear war, but the theme began much earlier.

131. NRH, p. 804.

132. "Origin and Development."

133. NRH, p. 804.

134. On the eve of the meeting, the commander of the air force wrote: "China's working class and scientists will certainly be able to make the most

up-to-date aircraft and atomic bombs in the not-distant future. . . . We can use atomic weapons and rockets made by the workers, engineers, and scientists of our country in coping with the enemies who dare to invade our country and undermine world peace. By that time, another new turning point will probably be reached in the international situation." Liu Yalou, pp. 9-10.

135. A Taiwan publication has given the text of these guidelines. See Guo Hualun, p. 13. This source does not state the exact date the Central Military Commission issued the eight guidelines.

136. *Jiefangjun Bao* [Liberation Army Daily], Jan. 16, 1958, in *Survey of China Mainland Press*, No. 1786 (June 6, 1958), p. 6. For an article that provides some context and a different perspective on the application of foreign experience, see Ford, especially pp. 160-65.

137. Mao [15], pp. 16-20 *passim*.

138. Quoted in Gittings, p. 231. In the announcement of the first hydrogen bomb test in June 1967, the Chinese heralded Mao's 1958 prediction: "Chairman Mao Tse-tung pointed out as far back as June 1958: I think it is entirely possible for some atom bombs and hydrogen bombs to be made in 10 years' time." *Xinhua* release, June 17, 1967, in FBIS: *Communist China*, June 19, 1967, p. CCC1.

139. *Renmin Ribao*, Aug. 1, 1958. This discussion is based on Ford.

140. *Renmin Ribao*, Aug. 2, 1958.

141. On Sept. 9, 1959, the Soviet news agency issued a statement on the border dispute. See "Origin and Development."

142. NRH, p. 805.

143. He Xiaolu, p. 166.

144. The information in this and the preceding paragraph is from NRH, pp. 805-6; and Li Jue et al., p. 32. The Soviet scientist Mikhail Klochko has recorded his observations about Chinese science, which suggest an alternative explanation: namely, Moscow considered China so backward that there was no way to help the PRC develop advanced weapons on its own. In 1964, Klochko wrote (p. 208): "We may conclude therefore that it will be a long time before China joins the nuclear club." Though in error in asserting that "the question would never arise of Khrushchev's handing Soviet nuclear weapons over directly to Mao," he does confirm that "all too often, the Soviet Union sent to China only middle-echelon specialists, especially when it came to matters of possible military application."

145. By July 16, the Soviet Union had delivered a note announcing its intention to recall 1,390 experts from China between July 28 and September 1. He Xiaolu, p. 172; "Riddle of Research and Development," p. 5; Li Jue et al., pp. 33-34.

第四章

1. For a popular treatment of the scientific quest to understand and manipulate the uranium atom, see Bickel, *Deadly Element*.

2. In the discussion of uranium geology, we have used two works published during the 1950s: Clegg and Foley, *Uranium Ore Processing*; and Holden, *Physical Metallurgy of Uranium*.

3. Clegg and Foley, p. 4.

4. *Ibid.*

5. *Ibid.*, p. 6.

6. The scintillation counter is regarded as being "far superior to a Geiger counter for aerial prospecting and generally . . . best for surface prospecting." *Ibid.*, p. 25.

7. Most of the information in this paragraph is from *ibid.*, pp. 27-33.

8. This section is based principally on Li Jue et al., pp. 11-13, 23, 26, 102-6, 108, 111-15, 134-35, 138.

9. Li Yingxiang et al.

10. Wang Aimin et al., pp. 80, 83.

11. Zhou Jinhan.

12. Zhou Enlai, *Report on Intellectuals*, p. 11.

13. One widely cited article in this regard is Di Zhongheng, "Chinese Communist Nuclear Forces." See especially Part 1: 3-11, and Part 2: 17. This 1976 Hong Kong article states that the nuclear physicists Qian Sanqiang and He Zehui, Qian's wife, organized a Sino-Soviet prospecting team to investigate uranium ore resources in Xinjiang as early as 1949. This team purportedly functioned prior to the establishment of the People's Republic on October 1. Di also states that two uranium mines opened near the provincial capital, Ürümqi, the following March. Soviet help allegedly included blueprints, machines, and experts, as well as the building and support of a uranium ore refinery. Four more mines were said to have been added in 1951 (two outside Xinjiang). Despite the substantial detail given in this article, we believe it is unreliable.

14. Whitaker and Shinn, p. 487. The Soviet writer I. N. Golovin states (p. 65): "The Government handed this assignment of graphite and uranium production to the Commissariat of non-ferrous metallurgy." Though the term "non-ferrous" includes uranium and thorium, and is sometimes used in the Soviet Union and China when the reference is to uranium, it does not necessarily mean uranium in either the Chinese or the Soviet usage.

15. A U.S. intelligence estimate of December 1960 stated: "The exploitation of native uranium resources has been under way with Soviet assistance since 1950. Over 10 deposits are now being worked, and we believe that ore with a uranium metal equivalent of several hundred tons is being mined annually and retained in China." U.S., CIA, "Chinese Communist Atomic Energy," p. 2 (declassified January 1986).

16. By the 1980s, uranium mines were operating at 26 locations in 24 provinces and autonomous regions. After 1984, nearly 60,000 people (including 14,000 technical personnel) served in 51 prospecting teams and 7 research institutes under the ministry's Geological Bureau; another 6,500 people worked in uranium geology teams under the Ministry of Geology and Mineral Resources and the Ministry of Metallurgical Industry. Li Jue et al., p. 103, and the map opposite p. 238. For an early discussion on the subject, see Gourievidis.

17. According to Wu Xiuquan (p. 25), the Soviet side provided the company with machinery, operational equipment, and technical know-how. Wu, a former vice-minister of foreign affairs and deputy chief of the General Staff, states that the Xinjiang region "abounds in copper, lead, aluminum, molybdenum, manganese, tin and other metals," but he does not mention uranium.

By 1985, when Wu's book was published, the Chinese were making no secret of later Soviet assistance in uranium exploration. As early as 1964, the Chinese had claimed that they had significantly aided Soviet military programs. In a famous letter to Moscow of February 29, the Chinese Party Central Committee said: "Up to the end of 1962 . . . China furnished the Soviet Union with more than 1,400 million new roubles' worth of mineral products and metals. . . . Many of these . . . are indispensable for the development of the most advanced branches of science and for the manufacture of rockets and nuclear weapons." Lithium, beryllium, and a number of other weapons-related metals are mentioned, but, again, uranium is not among them. *Seven Letters*, p. 25.

18. Zhao Zixing.

19. For a comparison of various countries' knowledge at that time, see Stead, pp. 714-21.

20. The Third Ministry became the Second Ministry of Machine Building in February 1958 and the Ministry of Nuclear Industry in May 1982. For a discussion of this ministry, see Chap. 3. After 1956, four more prospecting teams—182 (in Shanxi Province), 209 (Sichuan), 406 (Liaoning), and 608 (Jiangxi)—began operating. Li Jue et al., p. 23.

21. See Wang Yanting et al., p. 1031.

22. This paragraph is based on Wang Aimin et al., pp. 79, 80, 83.

23. Some sources refer to the mine as the Chenzhou Uranium Mine. Chenzhou is the historical name for Chenxian.

24. See Wang Jian et al., p. 6. Other information in this and the preceding paragraph is from interviews with Chinese specialists, 1986; and Li Jue et al., pages cited in note 8.

25. Unless otherwise cited, the discussion of Luo Pengfei's find is based on Zhao Fuxin and Zheng Shurong, pp. 58-61, 78. These authors discuss the search in the Nanling mountains but do not name the precise location; our assumption is that the locale is Lianxian.

26. *Ibid.*, p. 59. The character "lao" means old and is used as an affectionate title.

27. *Xinhua*, Dec. 2, 1979, in FBIS: *People's Republic of China*, Dec. 4, 1979, p. L15. This article does not identify the region, but from this report and others that appeared at the time, it is clear the mining region being discussed is in the Nanling mountains.

28. Zhao Fuxin and Zheng Shurong, p. 63.

29. *Ibid.*, pp. 65, 66, 74.

30. *Wenhui Bao* [Cultural Exchange News] (Hong Kong), Aug. 3, 1980, in FBIS: *People's Republic of China*, Aug. 5, 1980, p. U4.

31. See *Dagong Bao* [Impartial News] (Hong Kong), April 17, 1980, in *ibid.*, April 18, 1980, p. U1. According to this source, the Guangdong geological group number 705, working in the Nanling mountains, had made uranium discoveries almost every year since early 1964. See also Guangdong Radio, Dec. 26, 1979, in *ibid.*, Jan. 18, 1980, p. P2.

32. Zhao Fuxin and Zheng Shurong, p. 76. Picture 37, following Li Jue et al., p. 238, shows an external view of part of the Chenxian mine.

33. Wang Jian et al., p. 12.

34. For an authoritative discussion of shrinkage stoping, see R. Lewis and Clark, pp. 453-69.

35. *Ibid.*, p. 448.
36. *Ibid.*, p. 453; Wang Jian et al., p. 10.
37. R. Lewis and Clark, p. 453.
38. Wang Jian et al., p. 10; Wang Jingtang, p. 53.
39. Wang Jian et al., p. 8.
40. *Ibid.*, p. 12. For a technical discussion of Soviet leaching techniques that would have been available to the Chinese, see Galkin et al., pp. 39-43.
41. The discussion in this and the following paragraph is based principally on Wang Aimin et al., especially p. 81.
42. A general picture of how the military fared in these years is given in General Political Department, People's Liberation Army, *Gongzuo Tongxun* [Bulletin of Activities]. For a translation, see J. C. Cheng. A discussion of the relevant articles is found in J. Lewis, "China's Secret Papers," pp. 73-77.
43. By this time, the nuclear ministry had been renamed the Second Ministry of Machine Building, and Liu Jie had become the minister. On an inspection trip to Chenxian in 1963, Liu discovered that the drillers, contrary to ministry safety instructions, were working without access to water. The result was an increase in the density of dust in the tunnels far above the allowable 2 mg per cubic meter. Minister Liu personally ordered a Party cadre to fix the problem in three days. Wang Aimin et al., p. 84, gives the date for this event as March 1959; our sources indicate the date should be 1963.
44. The first national attention publicly given to protection against radon poisoning came in 1981. At the first national academic conference on radioactive environments in mines, participants exchanged information on occupational hazards in mines and proposed ways to reduce such harmful substances as radon. See China News Agency (Hong Kong), July 14, 1981, in *China Report: Science and Technology*, 136 (JPRS 79453; Nov. 16, 1981), p. 19. For a general idea of state-of-the-art mining safety, see Rock, pp. 111-21.
45. The term "ultra-Leftist" is Chinese. For a scholarly review of how Chinese evaluate ultra-Leftism during and after the Great Leap Forward, see Joseph, Chap. 4.
46. This and the next two paragraphs are based on Song Erlian; Wang Hanfu; Li Jue et al., pp. 30-31; and information from a Chinese specialist, 1986. The ministry also issued the slogan "Everyone should engage in the science of atomic energy."
47. Galkin et al., Chaps. 5-7, summarizes the state of Soviet knowledge (as of 1958) of the treatment of uranium at this stage in the process and lists many of the sources that would have been made available to the Chinese by Soviet advisers; see especially pp. 18, 34, 117-20, 140-41, and 154-55. Somewhat later, Galkin and others authored a textbook for the use of engineers specializing in the "technology of natural radioactive elements"; see Galkin and Sudarikov.
48. Wang Aimin et al., pp. 89-90.
49. Zhao Fuxin and Zheng Shurong, p. 76. Picture 25, opposite Li Jue et al., p. 15, shows one of the early uranium ore processing facilities like the one at Lianxian.
50. Xiang Jun, p. 120. The information on the ministry's collection system is based on interviews with Chinese specialists, 1986.
51. Galkin et al., Chap. 9, describes the textbook methods for producing uranium tetrafluoride.

52. Xiang Jun, pp. 118, 119. In accordance with their agreement of August 1956, the Soviets had designed the Sixth Institute. Li Jue et al., p. 26.

53. The remainder of this section is based principally on Xiang Jun, pp. 123-31; and Li Jue et al., pp. 44, 149. Lermontov is a small town near the city of Pyatigorsk in the Caucasus. The area of the Pyatigorsk Plateau, a section of the northern foothills of the Greater Caucasus, contains a number of mountain peaks of igneous origin. Some of these are exposed volcanic cores and are of a type in which uranium is sometimes found. Some sources have identified a uranium mine in the region; Xiang Jun appears to confirm that uranium oxide is produced at Lermontov.

54. Xiang Jun, p. 130.

55. *Ibid.*, p. 131.

56. This entire section is based on Jiang Ji, pp. 100-117; and Li Jue et al., pp. 26, 131, 148, 150, 155, 157, 163. The quote here is from Jiang Ji, p. 101. Hengyang was a city of about 240,000 in 1959. An important rail junction and market center, the city manufactures heavy equipment and machinery as well as chemicals and farm implements. It was about 70 miles by rail from the Chenxian Uranium Mine. The precise location of Plant 414 can be deduced from statements in Jiang Ji, pp. 116-17. Picture 41, following Li Jue et al., p. 238, shows the interior of Plant 414, described in this section.

57. Quoted in Jiang Ji, p. 102.

58. The story of Plant 202 is based on Li Jue et al., pp. 189-91. Pictures 46 and 48, following *ibid.*, p. 238, show the interior and exterior of Plant 202.

59. NRH, pp. 814, 816.

60. NRH, pp. 806, 814.

61. Niu Zhanhua, p. 133; Li Jue et al., pp. 43, 185.

62. See Guo Jian, pp. K7-K8; and Li Jue et al., p. 363. By the end of 1956, the institute had 584 staff members; 258 were scientific research personnel and 99 engineering technical personnel. According to Li Jinqi, the Institute of Atomic Energy had more than 1,300 engineers in 1986. He states that it "contributed to the successful trial explosion of China's first atom bomb and first hydrogen bomb" and conducts "basic research for national defense purposes." For a general description of the institute in 1979, see Bromley and Perrolle, pp. 87-100; and Bloembergen, pp. 92-93.

63. Guo Jian and Shuang Yin, pp. 1-3; Ren Gu, p. 1104. The first source gives an incorrect month for the beginning of the reactor's operation.

64. U.S. sources first identified Li Yi as a deputy director of the Institute of Atomic Energy in May 1965; U.S., CIA, *Directory* (1966), p. 454. By the 1980s, Li had moved to the new High Energy Physics Institute as deputy director. In October 1980, he became the first president of the China Particle Accelerator Society; *ibid.* (1981), pp. 21, 119.

65. Li Jue et al., p. 25; Niu Zhanhua, pp. 135, 148.

66. Niu Zhanhua, p. 142.

67. Information in this and the next paragraph is from *ibid.*, p. 134; and Li Jue et al., pp. 185, 420.

68. Monel is the trademark name for a nickel-copper alloy developed in 1905. Containing about 66% nickel and 31.5% copper (plus small amounts of other metals), Monel has strong corrosion-resistance properties.

69. Niu Zhanhua, p. 135.

70. This was the Zhangdian Medical Apparatus and Instruments Factory in Zibo, Shandong.

71. Li Jue et al., p. 185; Niu Zhanhua, p. 138. Huang Changqing's reactor was 2 m high and 0.5 m in diameter. Niu Zhanhua, p. 148. A possible model of the Soviet reaction chamber described by Niu Zhanhua is in Galkin et al., p. 151; however, the chamber pictured is designed to produce uranium tetrafluoride.

72. Li Jue et al., pp. 44, 185; Niu Zhanhua, p. 137. It should be noted that Li Jue et al. gives two different months for this test, October and December.

73. Niu Zhanhua, p. 139. "Xiao" means small and is a friendly title often used by a speaker addressing someone younger than he.

74. *Ibid.*, pp. 140-41.

75. *Ibid.*, pp. 142-43.

76. *Ibid.*, p. 146.

77. The information in this and the next paragraph is from *ibid.*, pp. 145, 147; and Li Jue et al., p. 185.

第五章

1. U.S., Department of Energy, p. 1. For a discussion of the development of Soviet nuclear weapons, see Holloway, *Soviet Union*, pp. 20-27.

2. Liu Shuqing and Zhang Jifu, pp. 34-35; interviews with a Chinese specialist, 1986; Li Jue et al., p. 42.

3. "Sino-Soviet Joint Communique," p. 34. The total amount of credits was 520 million rubles. "Communique on Sino-Soviet Talks," p. 31.

4. "Statement of Soviet Government," p. 53.

5. "Conclusion of the Sino-Soviet Accord."

6. At the inaugural meeting of the four departments of the Chinese Academy of Sciences in June, the academy's president, Guo Moruo, and the physicist Wu Youxun stressed the importance of nuclear physics. Guo appointed key defense scientists to the Physics, Mathematics, and Chemistry Department. See *Xin Hua Yuebao*, Sept. 28, 1955, pp. 127, 242, 243, and 246.

7. NRH, p. 795.

8. The major survey of Soviet assistance to China is Filatov. On the establishment of the Dubna institute, see *Xin Hua Banyuekan*, April 21, 1956, pp. 62-63; and Li Jue et al., p. 519. According to Moscow Radio, Feb. 1, 1981, "For several years, the number of Chinese scholars and experts working at that institute totaled 140." In FBIS: *Soviet Union*, Feb. 4, 1981, p. B2. For a full text of the Dubna agreement, see *Xin Hua Banyuekan*, Sept. 6, 1956, pp. 89-91.

9. NRH, p. 794.

10. The information in this and the following three paragraphs is from Qian Sanqiang, "Cherish the Memory"; and Li Jue et al., pp. 17, 491-92, 494-95.

11. Li Jue et al., p. 51; interviews with Chinese specialists, 1986. For similar scalings of the program, see Liu Jie; and "Riddle of Research and Development," p. 6. In 1986, Gu Mainan and Gu Wenfu reported (p. 3) that 300,000 staff and workers served on the "nuclear industrial front." Of these

300,000, about 60,000-70,000 were engineering and technical personnel and over 1,000 were senior scientific research personnel. Xue Jianhua.

12. Li Jue et al., pp. 168, 204, 232.

13. Mao [9], p. 288.

14. This and the following three paragraphs are based on interviews with Chinese specialists, 1986; and Li Jue et al., pp. 28-29. See also Wang Xianjin et al.

15. Zhou Yongkang; Xu Zhucheng. The figure of 10.7 billion yuan in 1957 is based on International Monetary Fund and World Bank figures for changes in the retail price indexes. IMF, pp. 274-75; World Bank, p. 334. The dollar conversion is based on a rate of 2.617 yuan per U.S. dollar in 1957, given in "Conversion Rates," p. 29.

16. These figures are from State Statistical Bureau, pp. 23-24. For a compilation of state expenditures from 1950 through 1959, see N. R. Chen, pp. 446-47. Defense spending for 1958 totaled 5 billion yuan.

17. Dai Yaping, "Nuclear City," pp. K19-K20; Li Jue et al., p. 42.

18. For a general introduction to plutonium, see William Miner. Miner is one of the authors of a more technical discussion of plutonium in *The Rare Metals Handbook*, 2d ed. (New York, 1961), Chap. 18.

19. *Encyclopaedia Britannica: Macropaedia*, 13: 318.

20. On nuclear reactor designs, see Nero, especially Chap. 1.

21. Hewlett and Anderson, p. 182.

22. U.S., CIA, "Chinese Communist Atomic Energy," p. 2.

23. Dai Yaping, "Nuclear City," pp. K19-K20. We have placed the location of the reactor site (part of the Jiuquan Atomic Energy Complex) near the Subei Mongolian Autonomous County on the basis of our analysis of information provided in Dai Yaping, "Nuclear Plant." The nuclear ministry approved the Subei site on Jan. 30, 1958. Li Jue et al., p. 204.

24. Dai Yaping and Zhao Jin. The 1958 population figure of 50,000 is from Ullman, p. 35.

25. The discussion of the three plants devoted to the production of plutonium metal and plutonium weapons is in Li Jue et al., pp. 68-69, 209, 418, and 430; and Dai Yaping, "Nuclear Plant," p. K5. Technical aspects of the reactor are described in Li Jue et al., pp. 204-15. On the technical aspects of China's chemical separation program, see *ibid.*, pp. 216-39. Information on the Plutonium Processing Plant, built in 1963, is in *ibid.*, p. 458. Pictures 49-52 and 54, following *ibid.*, p. 238, show several of these plutonium facilities.

26. Interviews with Chinese specialists, 1986. These codes were (1) "Provisional Regulations Concerning Health and Protection in Radioactive Work"; (2) "Standards for Gauging the Maximum Allowable Amounts of Ionized Radiation"; and (3) "Detailed Regulations Concerning Health and Protection in Work with Radioactive Isotopes." These codes divided factories into three zones: (a) workshops and equipment (*shebei*) that used radioactive materials; (b) workshops and maintenance facilities that had no radioactive equipment but might be radioactive; and (c) clean spaces that were not radioactive. The codes strictly controlled zone (a). This dangerous (*zang*) zone was isolated from the clean zone, and people had to pass through a safety zone to enter it. Monitors tested the radioactive film badges on the workers' belts and

the dosimeters in their upper left pockets when they left the zone. Everyone entering a dangerous zone had to be registered, to wear a mask, special gloves, and special rubber boots in the radioactive areas, and to shower and change clothes afterward.

27. Dai Yaping, "Nuclear Plant," p. K5; Li Jue et al., p. 233.

28. Most of the information in this and the next paragraph is from an interview with a Chinese specialist, 1985; and Li Jue et al., pp. 205, 421.

29. "Our Country."

30. Michael Minor, p. 576; Di Zongheng, 2: 22. Both of these articles assume the main reactor is in Baotou. According to Chinese interviewed, this is incorrect. The article cited in the preceding note indicates that the Chinese had 10 reactors in 1985. The following year, Jiang Shengjie (former chief engineer as well as first deputy director of the Jiuquan Atomic Energy Complex) claimed that there were more than that. Jiang, "Over Ten Reactors."

31. Whitaker and Shinn, p. 490.

32. *Ibid.*, p. 491; Liu Qijun, p. 40 (for the 1960s reports); Di Zongheng, 2: 22 (for the 1970s).

33. Michael Minor, p. 572; Liu Qijun, p. 41.

34. The information in this paragraph and the one that follows is based on Li Jue et al., pp. 565-66.

35. China's first thermonuclear explosion, on June 17, 1967, used a uranium trigger. See Appendix B for a list of China's nuclear tests through 1978.

36. Krass et al., p. 5.

37. See *ibid.*, Chaps. 1 and 2. For a more technical study, see Patton et al., especially Chap. 6: "Plant Design." The United States used electromagnetic separators for the enrichment of fuel for its first uranium bombs but abandoned this method in favor of gaseous diffusion. The Chinese Institute of Atomic Energy purchased two of these separators from the Soviet Union and experimented with this type of separation process for uranium. These separators now produce isotopes of elements other than uranium.

38. Arkin and Fieldhouse, p. 262. The United States also built gaseous diffusion plants in Paducah, Ky., and Piketon, Ohio.

39. See Hewlett and Anderson, pp. 136-41.

40. Although the case is not truly comparable, during the period 1943-60, the United States spent over two billion dollars on the construction and improvement of its gaseous diffusion plants. Patton et al., p. 1.

41. Hewlett and Anderson, p. 140. 42. Ullman, p. 35.

43. Xu Honglie. 44. Dai Yaping, "First Visit," p. K24.

45. The information in this paragraph is based on Dai and Zhao; and Chen Honggeng, p. 151. We have noted this decision of mid-October 1957 in Chap. 3. On Oct. 15 and Oct. 17, 1957, the Third Ministry approved the preliminary specifications for designing the Lanzhou plant and the Nuclear Fuel Component Plant in Baotou as the first ones in the series of mass-production facilities. Li Jue et al., pp. 168, 189.

46. Chen Honggeng, p. 151. Most of the information on the site selection is from Li Jue et al., p. 168.

47. For a general consideration of political networks in China, see J. Lewis, *Political Networks*.

48. For a thorough discussion of relationships within this army, see Whitson, Chap. 3.

49. *Ibid.*, p. 164.

50. One of these leaders, Peng Dehuai, writes (pp. 444-45): "Slanderers of the Hundred Regiments Campaign: You have gone over to the side of Japanese imperialism and the Chiang Kai-shek clique. Please read the [congratulatory] *telegram* Chairman Mao sent *me. Why is your view so different from* Chairman Mao's?"

51. See Whitson, pp. 177-86; and Clubb.

52. The information on Song Renqiong and Wang Jiefu is based on Chen Honggeng, p. 151; and Klein and Clark, 2: 787-90.

53. The biographical information on Zhang Pixu, Liu Zhe, and Wang Zhongfan is from Chen Honggeng, pp. 151-53.

54. *Ibid.*, pp. 153-54; on Deng Xiaoping's decision, see Li Jue et al., p. 27.

55. The information in this paragraph and the next is based principally on Liu Xiyao; Liu Shuqing and Zhang Jifu, pp. 34-35; and Li Jue et al., pp. 30, 168, 171-72.

56. We adopt Liu Xiyao's version of the "first write" slogan, using *xie*, instead of Liu and Zhang's *xue* (study).

57. For a discussion of the engineering and other technical aspects of building the plant, see Li Jue et al., pp. 419, 428-29. For additional information and a discussion of the security problem, see Chen Honggeng, pp. 156, 159, 160.

58. Chen Honggeng, pp. 156, 157. In a report of Jan. 6, 1961, on the "Provisional Regulations of the Chinese People's Liberation Army for the Safe-Keeping of State Military Secrets (Draft)," the General Political Department seems to have moved back to the earlier preoccupation with secrecy, especially as it related to the "super [scientific] departments" concerned with strategic weapons. See J. C. Cheng, pp. 232-38 *passim*.

59. Chen Honggeng, p. 161.

60. According to *ibid.*, the issue of cleanliness kept recurring in this area of violent winds and perpetual dust. The advisers often returned to the problem and "threatened to suspend the installation if the Chinese failed to maintain acceptable standards." The directorate's solution was to "command workers to level the land around the plant with bulldozers. . . . All electrical cables were put in trenches." The plant sent cadres south to Qinghai to find sod, which they shipped back to cover a vast area around the plant. Wang Jiefu won again, but the Soviets charged him with treating his work force brutally, a charge that the higher levels dismissed. The date of the installation is from Li Jue et al., p. 171. Picture 47, following *ibid.*, p. 238, shows the interior of the main workshop.

61. Chen Honggeng, p. 162; Li Jue et al., pp. 28, 565-66.

62. Chen Honggeng, p. 155. The information in this paragraph on the ministry's directive is from Li Jue et al., p. 28.

63. Dai Yaping, "Nuclear City," p. K19. This Politburo meeting was discussed in Chap. 3.

64. "Riddle of Research and Development," p. 5; Li Jue et al., p. 36. This decision, "The Eight-Year Program for the Atomic Energy Cause, 1960-1967," was issued on Dec. 23, 1959.

65. Su Fangxue, p. 5.

66. For additional information on the transfer of these specialists, see Dai and Zhao; Li Yingxiang et al.; Ding Houben, p. 16; and "Riddle of Research and Development," p. 5.

67. Chen Honggeng, p. 162; Li Jue et al., p. 33. Chen puts the date of departure on August 3, but Li states it was on July 8.

68. Chen Honggeng, pp. 162-63.

69. Dai Yaping, "Nuclear City," p. K19. In 1960, the state made an emergency allocation of "millions of catties" of soybeans to the nuclear plants in Lanzhou and Jiuquan Prefecture. Li Jue et al., p. 37.

70. Chen Honggeng, p. 163. Liu Jie formally replaced Song Renqiong as minister in September 1960. Liu, who had been a provincial and regional Party official in the early 1950s, served as vice-minister of geology and then vice-minister of the Second Ministry. "Appointments of Ministers."

71. Chen Honggeng, pp. 159, 164.

72. Quoted in Chen Zujia; "Riddle of Research and Development," p. 5; and Li Jue et al., p. 36.

73. Chen Zujia. Zhou Enlai first issued this oft-repeated instruction in 1959. Li Jue et al., pp. 36, 565.

74. Chen Honggeng, p. 163; Li Jinting et al., p. 18.

75. Dai and Zhao. Zhou Enlai's instruction echoed the words of a Politburo decision in June 1959, following receipt of Moscow's June 20 letter. Li Jue et al., pp. 36, 565.

76. Gu Mainan, "One Out of a Hundred Thousand."

77. Chen Honggeng, p. 163.

78. *Ibid.*, pp. 163, 164. Yuan Chenglong's background remains something of a mystery. This is one of the few mentions of his name in reports on the nuclear program, even though he served as vice-minister under both Song Renqiong and Liu Jie. The atomic bomb development program came under his direct authority until he was transferred from the ministry to become director of the Political Department of the National Defense Industry Office just before the Cultural Revolution.

79. Chen Honggeng, pp. 164, 165. This was a time for slogans and directives with numbers. See J. Lewis, *Leadership*, pp. 155-56.

80. Chen Honggeng, p. 164. A detailed discussion of the technical problems encountered in completing the Lanzhou plant is given in Li Jue et al., p. 174. The Chinese did not successfully test the Soviet-supplied barrier components with uranium hexafluoride until late 1962. Li Jue et al., pp. 175-76.

81. Chen Honggeng, p. 164.

82. *Ibid.*, p. 165.

83. This paragraph is based on Huang Fengchu and Zhu Youdi, p. 19; and Li Jue et al., p. 430.

84. Most of the information in this section is based on interviews with Chinese specialists from 1981 to 1983; and Li Jue et al., pp. 47-48, 567-68.

85. Personal communication from Nie Rongzhen, Feb. 15, 1986; Li Jue et al., p. 567.

86. Translations of 29 issues of the *Work Bulletin* are in J. C. Cheng; the quote is on p. 66.

87. *Ibid.*, pp. 66-67.

88. *Ibid.*, p. 100.

89. *Ibid.*, p. 250.

90. *Ibid.*, p. 253. For a discussion of the Chinese statements in the *Work Bulletin*, see Hsieh, "China's Secret."

91. NRH, p. 810. On Liu Shaoqi's alleged role at the Beidaihe meeting, see "Strategic Guiding Principles." Note that this article criticizing Liu predated his rehabilitation in 1980. The dismal fate of China's military aircraft industry mirrored the fate of the Soviet aircraft industry in Khrushchev's era. Since the decline of this industry in China has an important bearing on the missile program, we will deal with the industry's fate in our later study of that program.

92. NRH, p. 811.

93. NRH, pp. 811-12. The July "Resolution on Certain Questions in the Construction of the Nuclear Industry" called for strengthening all aspects of the program and tightening the transportation security system. Li Jue et al., p. 41.

94. NRH, p. 812. Chen repeated his remark on pawning his trousers to a group of Japanese newspapermen two years later. NYT, Oct. 29, 1963.

95. Quoted in Zhang Jun, p. 16.

96. NRH, pp. 812-13.

97. The report on a ground force training conference in 1961 called on PLA units at and above the regimental level to "study the principles of the use of atomic and chemical weapons and also [to] find out how to use our atomic and chemical weapons for sudden attacks." On July 13, the Central Military Commission ordered the relevant units to carry out the report's recommendations. See J. C. Cheng, pp. 684, 687.

98. *Ibid.*, pp. 732, 734.

99. Li Jue et al., p. 47; *Monan*, pp. 111-12; Liu Shuqing and Zhang Jifu, p. 25.

100. NRH, p. 819.

101. Chen Honggeng, p. 165; Li Jue et al., p. 47. The first source gives November 7 as the date of the Politburo decision.

102. The information on the commission's leadership is based on Gu Yu; and "Riddle of Research and Development," p. 6. According to Gu, both Nie Rongzhen and Luo Ruiqing were in charge of the commission's routine duties.

103. Various sources have previously identified some members of the commission. Marshal Nie Rongzhen provided the full list in a personal communication, Feb. 15, 1986. The ordering of the list is Nie's.

104. NRH, p. 819. Gu Yu adds that the commission "determined the key projects, the allocation of funds, and the coordination among various departments."

105. Li Jue et al., p. 48; "Riddle of Research and Development," p. 6. "Riddle" says that 9 meetings of the commission were held in this period, but Li Jue et al., pp. 48, 209, gives both 9 and 13 as the number.

106. NRH, pp. 785, 797, 819.

107. Wang Yougong et al.

108. Chen Honggeng, p. 166; Li Jue et al., p. 176. By this point in 1962, the construction and installation of the entire production line relevant to uranium processing and enrichment was 80% completed. "Riddle of Research and Development," p. 6.

109. This section is based on Chen Honggeng, pp. 166-71; and Li Jue et al., pp. 176-77.

第六章

1. Niels Bohr and John A. Wheeler collaborated on the article "The Mechanism of Nuclear Fission" (1939). For the reflections of some of the major participants in the revolution in nuclear physics in the 1930s, see Stuewer.

2. In general, the statement concerning publications is based on Glasstone and Dolan, *Effects of Nuclear Weapons*, Chap. 1. This classic volume was first published in 1950 as *The Effects of Atomic Weapons*. The first major unclassified volume to be published on nuclear weapons is Smyth, *Atomic Energy for Military Purposes* (1945). Specialists, including those in China, usually refer to this volume as the Smyth Report.

3. Glasstone and Dolan, p. 13.
4. *Ibid.*, pp. 13-14.
5. *Ibid.*, p. 15; Smyth, p. 210.
6. Glasstone and Dolan, p. 15.
7. *Ibid.*, pp. 15-16.

8. The Information Bureau of the Second Ministry, which was discussed in Chap. 3, scoured the literature on the explosive mechanisms. Chinese interviewed in 1986 state that general writings, such as the Smyth Report, provided little help, but that they got some valuable hints from Jungk, *Brighter Than a Thousand Suns*, and Groves, *Now It Can Be Told*. All such books and reports on the Manhattan Project were translated into Chinese and carefully annotated for use by Chinese scientists.

9. The definitive treatment of the British weapons effort is Gowing, *Independence and Deterrence*, Vol. 2: *Policy Execution*. The head of the Manhattan Project, Leslie R. Groves, writes (p. 147) that a national magazine published "an article hinting at the theory of implosion." Chinese sources indicate that this statement, for example, provided clues to where information on implosion might be found.

10. Gowing, *Independence and Deterrence*, 2: 457. An excellent description of the original American implosion devices is in O'Keefe, Chap. 3.

11. Holloway, "Research Note." In his analysis of the early Soviet nuclear weapons program, Holloway has reached two conclusions (p. 196): "First, although there are clear elements of reciprocal influence in the Soviet and American nuclear weapons decisions of 1949-52, the actions that are salient on one side are not necessarily so on the other. . . . Second, Soviet decision making shows elements both of reaction to American actions and of an internal dynamic." Holloway notes how one program stimulated aspects of the other.

12. Li Jue et al., pp. 257-58; "Riddle of Research and Development," p. 5; Liu Jingzhi and Li Peicai; Liu Shuqing and Zhang Jifu, p. 4.

13. Hewlett and Anderson, Chap. 7; the quotations are from pp. 228-29. Picture 63, following Li Jue et al., p. 238, shows buildings at the Ninth Academy and mountains in the distance.

14. Liu Shuqing and Zhang Jifu, pp. 2-4.

15. *Ibid.*, pp. 3-4; Li Yingxiang et al.

16. Li Jue et al., p. 261.

17. Liu Shuqing and Zhang Jifu, p. 4.

18. For a discussion of the construction of the railroad into the Haiyan area near the Ninth Academy between 1958 and 1961, see Bai Yunshan, pp. 30-31.

19. The information in the rest of this section is principally from Liu Shuqing and Zhang Jifu, pp. 29-30; and Li Jue et al., pp. 261-62.

20. The discussion of Wu Jilin's personal history is based on Liu Shuqing and Zhang Jifu, pp. 9-10; and Li Jue et al., p. 263.

21. On the timing of Wu's moves, see Li Yingxiang et al.; and Li Jue et al., p. 270.

22. The information on Zhu Guangya is based principally on Liu Shuqing and Zhang Jifu, p. 27; and Su Fangxue, p. 5. In 1951, Zhu had written a popular book on nuclear weapons entitled *Yuanzineng he Yuanzi Wuqi* [Atomic Energy and Atomic Weapons].

23. This information on Guo Yinghui is from Li Yingxiang et al.

24. This account of Wang Ganchang's background is based on "Ten Prominent Scientists," p. 27; and on information from scientists who know him.

25. Such stories were circulating as late as 1976. See Di Zongheng, Part 2, p. 19. Wang left Germany well before the German nuclear program began in the fall and winter of 1939-40. See Irving, Chap. 2. It is true that Professor Werner Heisenberg, a major physicist in Berlin, became involved in defense-related nuclear issues while Wang was still in Germany, but Wang did not work with him or indeed even know him.

26. Liu Shuqing and Zhang Jifu, p. 6.

27. For this and other details on Wang Ganchang's career, see Ding Houben, p. 16; "Riddle of Research and Development," p. 5; and Li Jue et al., p. 565.

28. Li Jue et al., p. 270; Liu Shuqing and Zhang Jifu, p. 11.

29. Liu Shuqing and Zhang Jifu, p. 7.

30. *Ibid.*, pp. 7, 11; Feng Yuan and Chen Dong.

31. The details on Guo Yonghuai are from Liu Shuqing and Zhang Jifu, pp. 7-8, 11; and Li Jue et al., p. 270.

32. Tien, "Engineering," p. 388. In the Wade-Giles orthography, Guo's surname is Kuo.

33. After a series of ambassadorial talks in Geneva, the United States and China issued parallel unilateral statements on Sept. 10, 1955, expressing their intent "to resolve the problem of the repatriation of remaining civilians" detained by the two countries. The United States thereupon began allowing some of the 129 Chinese students and scientists it had detained to return home. Guo was among those granted a visa.

34. Interview with a Chinese specialist, 1984. On Guo's death, see Liu Shixiang, p. 20.

35. Liu Shuqing and Zhang Jifu, p. 40.

36. Liu Shixiang, p. 24; Li Jue et al., pp. 268-69.

37. Liu Shuqing and Zhang Jifu, pp. 13, 17. *Mimi Licheng* refers only to a Dr. Chen working in this area. We assume this is Chen Nengkuan because Nie Rongzhen places him, along with Qian Sanqiang, Wang Ganchang, Zhu Guangya, and Peng Huanwu, in a group of major scientists in the atomic

program; NRH, p. 788. *Renmin Ribao*, Jan. 9, 1956, identifies Chen as a returned student from the United States.

38. Liu Shuqing and Zhang Jifu, pp. 30-33.

39. This information on Deng Jiaxian is based on *ibid.*, p. 19; Gu Mainan, "Deng Jiaxian, Veteran Scientist"; Gu Mainan, "Deng Jiaxian, Man of Merit," pp. 4-8; Liu Jingzhi and Li Peicai; Su Fangxue, pp. 2-9; Zhang Aiping, "Deng Jiaxian's Illustrious Name"; and Zhang Aiping, "Memorial Speech." After Deng's death in July 1986, Chinese articles referred to him as the "father of China's atomic bomb" and the "Oppenheimer of China"; we believe these sobriquets to be exaggerations. See, for example, Gu Mainan, "Deng Jiaxian: China's Father of A-Bomb," pp. 20-22.

40. Su Fangxue, p. 4.

41. Liu Shuqing and Zhang Jifu, p. 19; Gu Mainan, "Deng Jiaxian, Veteran Scientist."

42. Liu Shuqing and Zhang Jifu, pp. 19-20; Feng Yuan and Chen Dong; Liu Jingzhi and Li Peicai.

43. Liu Shuqing and Zhang Jifu, p. 21.

44. *Ibid.*, p. 56.

45. *Ibid.*, pp. 4-5.

46. *Ibid.*, pp. 5-7.

47. *Ibid.*, p. 8. There is an oddity in this account, which has Peng Dehuai, who was dismissed from his post as defense minister in September 1959, among these senior leaders. His inclusion in the group appears to be a mistake. "Khrushchev's perfidious actions" refers to the Soviet letter of June 20, 1959, which postponed delivery of a prototype weapon. This letter is discussed in Chap. 3. The Chinese named the bomb "596" in August 1963. Li Jue et al., p. 53.

48. Except as noted, this section is based principally on Liu Shuqing and Zhang Jifu, pp. 10-18; and Li Jue et al., pp. 259-60, 264-68, 270.

49. See, for example, O'Keefe, pp. 65-67.

50. Data on the location is from "Monument."

51. The "over 30" figure comes from Ding Houben, p. 16.

52. Liu Shuqing and Zhang Jifu, p. 40. The Xi'an-based Third Institute and Plant 804, both under the ministry in charge of conventional weapons, assisted Qian Jin. Li Jue et al., p. 267.

53. Engineers at the Lanzhou Chemical Physics Institute helped develop new explosives and casting techniques. Li Jue et al., p. 268. For data on mixtures used in the U.S. nuclear program and relevant performance data, see Mader et al. Most of the available explosives were developed before or during the Second World War. Information on these would have been easily available to Chinese ordnance specialists, many of whom had worked with U.S. army specialists in China. For a description of TNT, PETN, and other military explosives, see Meyer; and Fordham, Chap. 3.

54. Scientists at the Computing Technology Institute in Beijing conducted these calculations on a Model 104 computer, then China's most advanced but primitive by Western standards. Li Jue et al., p. 267. The physicist Richard Feynman notes (p. 108) that at wartime Los Alamos the "big problem . . . was to figure out exactly what happened during the bomb's implosion, so you can figure out exactly how much energy was released and so on. [This] required

much more calculating than we were capable of. A clever fellow by the name of Stanley Frankel realized that it could possibly be done on IBM machines [used] for business purposes."

55. The date is from "Monument."

56. The number 2,000 is based on the comparable U.S. implosion device dropped on Nagasaki, which had 32 detonators fired with the simultaneous discharge of electrical capacitors. For details, see O'Keefe, pp. 77-79, 99. The detonation experiments continued until early 1964. "Monument."

57. For the English translation of a Soviet text on beryllium published in 1956, see Beus. On p. 44, the author describes the beryllium deposits found in China.

58. In the British nuclear weapons project, polonium was artificially produced at the Atomic Energy Research Establishment at Harwell. Gowing, *Independence and Deterrence*, 2: 445-46.

59. Bagnall, pp. 935, 944, 946. Bagnall writes (p. 946): "Polonium [compared to selenium and tellurium] is the most dangerous of the three elements because of its intense radioactivity; all three elements appear to be taken up by the kidneys, spleen and liver, the tissues of which undergo irreparable radiation damage in the case of polonium because of the complete absorption of the α-particle energy." The most important Western technical study of polonium, to which the Chinese would have had access, is Moyer et al., published in July 1956.

60. Most of the information in this paragraph is based on Glasstone and Dolan, pp. 16-17.

61. According to *Encyclopaedia Britannica: Macropaedia*, 12: 1072, neutrons are classified by their energy and wavelength. "It is common to describe neutrons with energies in the range from 0 to 1000 eV as slow, 1 to 500 keV as intermediate, 0.5 to 10 MeV as fast, and greater than 10 MeV as very fast."

62. Glasstone and Dolan, pp. 16-18. On p. 17, the authors note that for a complete fission of 0.1 kilotons, it "would take approximately 51 generations to produce the necessary number of neutrons" in a chain reaction initiated by only one neutron.

63. *Ibid.*, p. 17.

64. Liu Shuqing and Zhang Jifu, pp. 22-23.

65. The rest of this section is based primarily on *ibid.*, pp. 23-33; "Riddle of Research and Development," p. 6; and Li Jue et al., pp. 265, 268, 376, 569. The information on polonium is from Moyer et al., pp. 2-6.

66. This and the final three paragraphs in this section include information from Li Jue et al., pp. 53-54, 262-63, in addition to the sources given in note 65.

67. Liu Jingzhi and Li Peicai; Gu Mainan, "Deng Jiaxian, Veteran Scientist."

68. The information in this paragraph and the following one is from Su Fangxue, pp. 4-5; and interviews with a Chinese specialist, 1986.

69. Liu Shuqing and Zhang Jifu, pp. 19-20.

70. *Ibid.*, pp. 19-21; Liu Jingzhi and Li Peicai; "Riddle of Research and Development," pp. 5-6; Li Jue et al., p. 276. The next two paragraphs are based on these sources.

71. This is based on Li Jue et al., pp. 412, 418, 478.

72. See Chap. 5, note 23.

73. Liu Shuqing and Zhang Jifu, pp. 37-38.

74. Gobi is a Mongolian word meaning "a place difficult for bushes and trees to grow well." In most accounts of the nuclear weapons program, it is used generically to include not only the desert formally called Gobi in Nei Mongol, but also the deserts or wilderness in Gansu, Qinghai, and Xinjiang. This is a proper though somewhat uncommon usage. See *Ci Hai*, p. 1349.

75. Dai Yaping, "Nuclear Plant," p. K5.

76. Chen Zujia; Peng Ruoqian, pp. 172, 174, 175.

77. Peng Ruoqian, pp. 175-76.

78. Liu Shuqing and Zhang Jifu, p. 33; Peng Ruoqian, p. 176.

79. Liu Shuqing and Zhang Jifu, p. 33.

80. *Ibid.*, pp. 33-34.

81. Peng Ruoqian, pp. 183-84.

82. Liu Shuqing and Zhang Jifu, p. 34.

83. *Ibid.*, pp. 25-26; Li Jue et al., pp. 46-47. The ministry's report in September led to a series of decisions, and there is some confusion concerning which of these should be called the Two-Year Plan. See Li Jue et al., p. 568.

84. Liu Shuqing and Zhang Jifu, p. 34.

85. *Ibid.*

86. *Ibid.*, p. 35.

87. Peng Ruoqian, pp. 185-87; Liu Shuqing and Zhang Jifu, p. 37. By adopting Zhu's plan, the project reportedly saved the national treasury 21 million yuan (or about U.S.$10 million in 1963 dollars).

88. Peng Ruoqian, pp. 179-80.

89. *Ibid.*, pp. 178-79.

90. *Ibid.*, p. 180.

91. Liu Shuqing and Zhang Jifu, pp. 35-37.

92. *Ibid.*, p. 38; Peng Ruoqian, p. 185.

93. The information on Yuan Gongfu's feat is from Liu Shuqing and Zhang Jifu, pp. 38-40; Peng Ruoqian, p. 187; and "Riddle of Research and Development," p. 6. The last source states that the machining was completed in April, not on May 1.

94. Except as noted, the rest of the section is based on Liu Shuqing and Zhang Jifu, pp. 41-44. We do not know Engineer Li's full name. On the criticality experiment, see Li Jue et al., pp. 272-73.

95. Li Yingxiang et al. Liu Xiyao, who was present at the assembly stage, writes that the first bomb had been produced "by July 1964," but this may not include assembly.

96. Liu Xiyao reveals that at this same time Zhou issued a directive to "pay close attention to the combination of the atomic bomb and guided missiles."

第七章

1. In 1980, for example, archeologists from the Xinjiang Institute of Archeology completed a survey of the Loulan site, which had earlier been explored by Sven Hedin. *Xinhua*, Jan. 19 and July 1, 1980; Hedin, *Wandering Lake*. Perhaps the best-known explorer of the Lop desert was Sir Aurel Stein; see his "Third Journey"; and "Explorations."

2. The total land area of Xinjiang is 1.6 million sq. km, of which over 100,000 sq. km is devoted to the nuclear weapons test base.

3. Fa-hsien, p. 17; Huili, pp. 36-37.

4. Marsden, pp. 68, 78.

5. Schomberg, p. 318.

6. In 1915, Stein discovered that "brackish water could be reached [in the Kuruktag] by digging shallow wells in some hollows." *On Ancient Central-Asian Tracks*, p. 132.

7. Schomberg, p. 318.

8. Stein, "Explorations," pp. 18, 24.

9. Stein, "Third Journey," 2: 205.

10. Pevtsov, Chap. 7; in Chap. 8, Pevtsov provides a good description of Korla and Yanqi (Karashar), which we will summarize in our later volume on the missile program.

11. *Ibid.*, p. 312.

12. The main fishing in the region is at Bosten Hu (Bagrax Hu). For a description of this large freshwater lake east of Yanqi, see Murzayez, pp. 75-83.

13. Pevtsov, pp. 313, 328-30. In the mid-1950s, the Uygurs accounted for almost 75% of the total Xinjiang population of about 5.0 million. By the 1970s, their representation had dropped to about 55%, in a population that had grown to 8.5 million, reflecting a large influx of Han settlers from provinces to the east. For a discussion of this general phenomenon of population redistribution, see Orleans, Chaps. 4, 5.

14. Pevtsov, pp. 322, 331. There were a great many Chinese soldiers elsewhere in the province at this time as a holdover from the great Muslim rebellions and anti-foreign battles two decades before. See Wen-Djang Chu.

15. Stein, "Explorations," p. 12. For pictures of these topographical features, see *ibid.*, pp. 10, 25.

16. Hulsewe, p. 89.

17. For a discussion of this campaign and its aftermath, see Whitson, pp. 113-22.

18. This paragraph is based on Whiting and Sheng, pp. 115-18; and Wang Zhen. For a review of the complex history surrounding the Communist takeover of Xinjiang, see Forbes, Chap. 7.

19. Fu Biduo and Tian Jijin.

20. According to McMillen, p. 66, the PC Corps membership had "risen to an estimated 500,000 to 600,000" in 1966. By 1985, its ranks had swelled to some 1.0 million (or 2.25 million counting family members). See Lan Xueyi; and "PC Corps' Contributions."

21. McMillen, pp. 56-67; Whitson, pp. 114-15.

22. See Nailene Chou.

23. This section is based on Zhang Zhishan; and Su Kuoshan.

24. Su Kuoshan. October 16 is the anniversary of both the establishment of the base and the explosion of the first bomb. See *Xinhua*, Oct. 5, 1984, in FBIS: *China*, Oct. 9, 1984, pp. K13-K14.

25. Guo Diancheng and Xu Zhimin, "Real People's Heroes," p. 18.

26. *Xinhua*, Oct. 16, 1984, in FBIS: *China*, Oct. 17, 1984, p. K1; interview with a Chinese specialist, 1986. On the First Atomic Bomb Test Commission

and the First Atomic Bomb Test On-Site Headquarters, see "Celebration of the Twentieth Anniversary."

27. This paragraph is based on Guo Diancheng and Xu Zhimin, "Thunder Roars," p. 17.

28. This paragraph is based on Guo Diancheng and Xu Zhimin, "Real People's Heroes," p. 18.

29. Interviews with former PC Corps members, August 1985.

30. There was little difference between the soldier-prisoners and those confined to the famous Communist Youth League Farm in the Taklimakan Desert south of Korla. This reform-through-labor camp came under the jurisdiction of the Talimu Administrative Office and was one of the PC Corps units. Most of those confined to the farm came from China's eastern provinces.

31. These were distinguished from *zhibian liandui* (support-the-frontier companies), which were made up of volunteer youth from China's eastern metropolitan areas. The *zhibian liandui* were viewed by the local authorities as a reserve security force to be mobilized in emergencies.

32. The information in this paragraph and the next one is based principally on Guo Diancheng and Xu Zhimin, "Thunder Roars," pp. 17-18; and interviews with former PC Corps members, 1985.

33. Liu Nanchang and Liu Cheng.

34. Guo Diancheng and Xu Zhimin, "Real People's Heroes," p. 19. On the date of the Research Institute's establishment, see Nie Rongzhen, "Letter," p. 18. We believe the name of this institute is the Northwest Nuclear Technology Institute, which in 1967 was led by Cheng Kaijia. Li Jue et al., p. 291.

35. Suo Guoxin, pp. 16-19.

36. See Guo Diancheng and Xu Zhimin, "Never Forget," pp. 28-29.

37. The Chinese press frequently cites the building of the meteorological station in the high mountains of Xinjiang as a miracle of the test program. See, for example, *Xinhua*, Oct. 5, 1984, in FBIS: *China*, Oct. 9, 1984, p. K14.

38. Guo Diancheng and Xu Zhimin, "Real People's Heroes," p. 19.

39. Except as noted, the information on the delivery of the weapon is based on Liu Shuqing and Zhang Jifu, pp. 44-48.

40. The date is from "Riddle of Research and Development," p. 6.

41. On April 11, 1964, the Fifteen-Member Special Commission decided to detonate the first bomb on a tower. Li Jue et al., p. 54. The rest of this section is based principally on Liu Shuqing and Zhang Jifu, pp. 49-56; "Riddle of Research and Development," p. 6; and Li Jue et al., pp. 54-55, 274-75.

42. "Unexpected Discovery."

43. This paragraph is based on Ding Houben, p. 16, as well as Liu Shuqing and Zhang Jifu, p. 49.

44. Liu Shuqing and Zhang Jifu, pp. 51-52; "Riddle of Research and Development," p. 6; Li Jue et al., pp. 55, 275. Throughout this section, where the sources differ, we have chosen to follow "Riddle"; and Li Jue et al. For example, Liu and Zhang state that the command to insert the uranium component and initiator was given on the sixteenth, and that the command to hoist the bomb up the tower came at 6:00 that morning.

45. Interviews with Chinese specialists, 1986.

46. Li Yingxiang et al.; Guo Diancheng and Xu Zhimin, "Never Forget," pp. 28-29.

47. Xie Linhe, pp. 17-18. The fallout reached Beijing at 10:00 A.M. on October 17.

48. In interviews conducted in August 1985 with former servicemen stationed in Xinjiang, we were told that Beijing did not give the problem "serious attention" until the late 1970s. A substantial amount of data has been released in China concerning atmospheric tests conducted from 1976 to 1979. See, for example, Radiochemistry Research Laboratory, pp. 173-79; and Liang Yusheng et al., pp. 11-16. During the atmospheric test series, probably in the 1960s, Premier Zhou Enlai ordered the development of underground testing speeded up. Thereafter, the Second Ministry created what came to be named the Research Unit on Underground Nuclear Testing Phenomena; Liu Zhaolin, p. 14. In October 1967, a high-level meeting worked out plans for underground testing, but these were interrupted by the Cultural Revolution. The first underground explosion came on Sept. 22, 1969, and the Chinese basically solved the technical problems associated with underground measurement in their tests on Oct. 27, 1975, and Oct. 17, 1976. Li Jue et al., p. 291. To date, all tests subsequent to the atmospheric test on Oct. 16, 1980, have been conducted underground.

49. Ling Xiang, p. 63. This article reveals that members of expeditions into the desert, though dozens of miles from the restricted zone, have suffered from severe radiation exposure.

50. Suo Guoxin, p. 18. Suo incorrectly states that "virtually all" the scientists and technicians suffered from serious fallout radiation of "several hundred roentgens"; interviews with Chinese specialists, 1987, indicate that Suo was exaggerating.

51. Liu Shuqing and Zhang Jifu, p. 52. Picture 60, following Li Jue et al., p. 238, shows the bomb on its push cart. No. 61 shows the tower, and No. 59 an observation post and the ground zero terrain.

52. Liu Shuqing and Zhang Jifu, p. 52. August 1 is the official anniversary of the founding of the People's Liberation Army.

53. Li Yingxiang et al. See also Guo Diancheng and Xu Zhimin, "Never Forget," pp. 28-29; Su Kuoshan; and "Riddle of Research and Development," p. 6.

54. Liu Shuqing and Zhang Jifu, p. 54; "Riddle of Research and Development," p. 6.

55. Except as otherwise cited, the information in this paragraph is from Liu Shuqing and Zhang Jifu, pp. 54-55.

56. See Zheng Jixu et al.; Cai Jianwen. China did not put an advanced air-sampling system into operation until Oct. 17, 1976; Ding Houben, p. 17.

57. "Major Development."

58. This paragraph and the next one are based on Ding Houben, p. 16; and Liu Shuqing and Zhang Jifu, p. 55. The quotation is from Liu and Zhang.

59. Liu Shuqing and Zhang Jifu, pp. 1-2.

60. For the text of the official statement, see Appendix A.

第八章

1. Einstein's precise words, as quoted in Lapp, were: "The unleashed power of the atom has changed everything save our modes of thinking, and we thus drift toward unparalleled catastrophe."

2. Dinerstein, p. 7.

3. For a general discussion of this year, see Hsieh, "Sino-Soviet Nuclear Dialogue," Chap. 8.

4. "Leninism and Modern Revisionism."

5. We have used the translation of this *Hongqi* article (Nos. 3-4, March 4, 1963) in *More on the Differences Between Comrade Togliatti and Us.*

6. *Ibid.*, p. 158.

7. *Ibid.*, pp. 69-78.

8. "A Proposal Concerning the General Line of the International Communist Movement" (June 14, 1963), in *Polemic*, pp. 28-29.

9. The text of the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water is in Blacker and Duffy, pp. 366-68.

10. "Statement of the Chinese Government Advocating the Complete, Thorough, Total and Resolute Prohibition and Destruction of Nuclear Weapons and Proposing a Conference of the Government Heads of All Countries of the World" (July 31, 1963), in *People of the World*, p. 1.

11. *Ibid.*, p. 2. For a general discussion of China's attitude toward the treaty, see Halperin, pp. 62-70.

12. "Statement by the Spokesman of the Chinese Government" (Aug. 15, 1963), in *People of the World*, p. 21.

13. *Ibid.*, p. 22.

14. *Ibid.*, pp. 27-30.

15. "Statement of the Soviet Government of August 21, 1963," in *People of the World*, p. 196.

16. "Statement by the Spokesman of the Chinese Government" (Sept. 1, 1963), in *ibid.*, pp. 38-39.

17. *Ibid.*, pp. 54-60.

18. Quoted in Hsieh, "Sino-Soviet Nuclear Dialogue," p. 164.

19. *Ibid.*, pp. 164-65.

20. "Two Different Lines," pp. 246, 255.

21. For example, see "PLA Conference"; "On Man"; and "Put Ideological Work in the Primary Position."

22. Hung Fan-ti, "Strategy of 'Flexible Response,'" especially p. 6. For a different type of critique of U.S. defense policies, see "MLF," which notes: "In order to prevent a nuclear war, the first thing to do is to oppose U.S. imperialism. . . . Nuclear weapons are created by man. They can also be destroyed by man."

23. The text of the speech is in *Xinhua*, Aug. 1, 1964, in *Survey of China Mainland Press*, No. 3273 (Aug. 6, 1964), pp. 40-45.

24. See Halperin and Lewis, pp. 58-67; and Whitson, pp. 528-57.

25. This group, led by Qian Sanqiang, was called the Neutron Physics Leading Group. Except as noted, the information in this paragraph and the rest of this section is based on "Riddle of Research and Development," pp. 6-7; and Liu Xiyao, "How China Succeeded."

26. Feng and Chen; Yu Min; Li Jue et al., pp. 61, 276.

27. Liu Jingzhi and Li Peicai.

28. Glasstone and Dolan, p. 20.

29. This paragraph and the one that follows are based on Postol. (This article, prepared for publication in *Encyclopedia Americana*, is cited by permission of the author.)

30. Liu Xiyao; "Riddle of Research and Development," pp. 6-7; Li Jue et al., pp. 62, 277-78, 367. Information in the following five paragraphs is from these sources. Liu specifically mentions using computers of the Chinese Academy of Sciences' institutes in Beijing and Shanghai. The most advanced computer used was the J-501 Model at the East China Computer Institute in Shanghai. By way of comparison, the scientists at Los Alamos in the wartime project had "Marchant computers—hand calculators with numbers. You push them, and they multiply, divide, add, and so on, but not easy like they do now. They were mechanical gadgets, failing often." Feynman, p. 108.

31. This is based partially on Yu Min; and Liu Jingzhi and Li Peicai. Yu Min had studied physics under Deng Jiaxian at Beijing University and joined the Ninth Academy in 1965. Shortly before Yu went to Shanghai, the ministry submitted its "Report on Arrangements for Making Breakthroughs on Hydrogen Bomb Technologies" (August 1965). It called for combining laboratory experiments with actual weapons tests. Li Jue et al., pp. 62, 366.

32. All the scientists reportedly were assigned to read Mao's "On Practice" and "On Contradiction," as well as political directives and tracts on "learning from Daqing," the oilfield then being touted as a model of industrial self-reliance. For a brief historical review of the early years of the Cultural Revolution, see "China, History of," *Encyclopaedia Britannica: Macropaedia*, 4: 396-400.

33. "Hold High the Great Banner."

34. In a 16-point directive of Aug. 8, 1966 ("Decision of the Central Committee of the Chinese Communist Party Concerning the Great Proletarian Cultural Revolution"), the Central Committee accepted, though in modified form, article 12, which said: "Special care should be taken of those scientists and scientific and technical personnel who have made contributions." Text in *CCP Documents*, p. 52. In January 1967, the Central Military Commission forbade assaults on "war preparation systems and security systems in the armed forces" (text in *ibid.*, p. 212), and on February 7, the central leadership issued a "Circular . . . Forbidding Exchange of Revolutionary Experience in Industrial and Mining Units, Scientific Research Organs, Design Units and Capital Construction Units Under the Industrial System for National Defense" (text in *ibid.*, p. 232).

35. Except as noted, the information in this and the following paragraph is from Liu Jingzhi and Li Peicai.

36. The information on the design unit is based on "Triumphal Song of Mao Zedong's Thought," p. ccc16.

37. For a sample of news stories and the official communique on this test, see FBIS: *Far East*, Oct. 28, 1966, pp. CCC1-CCC3. The character *xi* (double happiness) is used for weddings and other special celebrations.

38. This paragraph is based on Nie Rongzhen, "How China Develops Its Nuclear Weapons," p. 19.

39. "Mao Tse-tung's Thought Is the Victorious Banner," pp. 16-17.

40. The information on the Second Ministry is based on interviews with a Chinese specialist, 1986. Shortly after the outbreak of the Cultural Revolution, Minister Liu Jie was stripped of his power. Premier Zhou Enlai then assigned Vice-Ministers Liu Xiyao and Liu Qisen to oversee the day-to-day affairs of the ministry. They remained in power for several years.

41. The information in this and the following two paragraphs is principally from Suo Guoxin, pp. 16-18.

42. Article 8 of the "Provisional Regulations of the Chinese People's Liberation Army for the Safekeeping of State Military Secrets (Draft)" states: "Test sites for new weapons . . . must be properly classified as restricted areas." Text in J. C. Cheng, p. 239.

43. "Document of the CCP Central Committee, the State Council and the Central Military Commission," in *CCP Documents*, p. 186.

44. We shall review the events of the Cultural Revolution in our subsequent study of the missile program.

45. "Riddle of Research and Development," p. 7; Li Jue et al., p. 63. At the meeting on May 9, the commission placed the Party committee of the Lop Nur base in command of the forthcoming test. It reversed this decision a few weeks later.

46. The information in this and the following paragraph is from Ding Houben, p. 17.

47. Guo Diancheng and Xu Zhimin, "Never Forget," p. 28; Li Jue et al., p. 283. The H-bomb, dropping by parachute, is shown in picture 62, following Li Jue et al., p. 238.

48. For a compilation of documents on this test, see FBIS: *Communist China*, June 19, 1967, pp. CCC1-ccc12, and June 20, 1967, pp. ccc9-ccc20. On Nie's role, see Nie Rongzhen, "How China Develops Its Nuclear Weapons," p. 19. The Nie article incorrectly gives June 14 rather than June 17 as the date of this test.

49. This information is based on "Triumphal Song of Mao Zedong's Thought," pp. ccc17-ccc18.

50. Information in this and the next two paragraphs is from Lu Chuanzhi et al.; and Xi Qixin and Liu Jingzhi.

51. The information in the rest of this section is from "Triumphal Song of Mao Zedong's Thought," pp. ccc18-ccc20.

52. The information in this section is from Li Jue et al., pp. 49, 59-61, 63, 276, 285-91; Lu Ke, pp. 9-11; and Wang Zhuang, pp. 64-65.

53. "China's First Hydrogen Bomb," pp. 6-7.

54. *Ibid.*; "A Magnificent Victory," p. CCC4.

55. These emphases all come within what the political scientist Allen Whiting has termed "the calculus of deterrence" adopted by China in conflicts with India and with the United States in Vietnam. Whiting, *The Chinese Calculus*, especially Chap. 7.

56. NRH, p. 787.

57. Du Yuejin, p. 13.

58. Mao [9]. See especially pp. 288-89.

59. See, for example, Wang Shouyun, pp. 26-27.

60. "On Questions of Party History," p. 31.

61. As each of the four missiles became operational, the West designated them by a CSS number (CSS-1 through CSS-4). Most of the information in the rest of this section is from interviews with Chinese specialists, 1985; and from Zhang Jun, as noted.

62. Zhang Jun, p. 41.

63. *Ibid.*, pp. 562-63.

64. U.S. government reports regularly described this medium-range ballistic missile as a "single-stage, liquid propellant, transportable system developed from Soviet models. . . . It can reach targets in the Eastern USSR, peripheral nations, and some US bases in the Far East. It is an obsolescent and cumbersome missile system with slow reaction time." These reports gave an estimated range of about 600 nautical miles, or 1,100 km, which the Chinese say slightly underestimates the maximum range. See Brown, *U.S. Military Posture, FY 1976*, p. 48.

65. Zhang Jun, p. 565.

66. Jones, *U.S. Military Posture, FY 1981*, p. 76. In the late 1970s, the Chinese began to withdraw the DF-2 from the missile force. Interview with Chinese specialists, 1987.

67. Some U.S. sources state that the DF-4 (CSS-3) had a maximum range of 4,350 miles (about 7,000 km), but Chinese specialists say this is incorrect. See "Chinese Develop Missile, Satellite Launchers," p. 16.

68. This is based on Du Hua et al.; and "Outstanding Achievements."

69. U.S., Department of the Air Force, pp. 3.10-3.14.

70. The DF-5 used UDMH and an oxidizer of 100% nitrogen tetroxide.

71. Zhang Jun, p. 182. On the development of graphite control vanes, see Ley, Chap. 8. A picture of graphite vanes on the German V-2 (A-4) is in Ley, p. 195.

72. On these control systems, see U.S. Department of the Air Force, pp. 7.11-7.18. This information is from a Chinese specialist, 1986; Du Hua et al.; Zhang Jun, pp. 176, 180-82.

73. Information from a Chinese specialist, 1986.

74. Zhang Jiajun.

75. Guo Qingsheng, pp. 23-24.

76. Du Hua et al.

77. Schlesinger, p. 31.

78. Brown, *U.S. Military Posture, FY 1978*, pp. 5, 106.

79. For an examination of Chinese statements on deterrence, see J. Lewis, "China's Military Doctrines," especially pp. 151-58.

80. NRH, p. 810.

81. Wang Shouyun, pp. 26-27. Wang cites an article on medium nuclear powers by Geoffrey Kemp (*Nuclear Forces for Medium Powers*) as giving a sound explanation of China's strategy.

82. "Statement by the Government of the People's Republic of China."

83. Quoted in Yin Weixing, p. 21. Yin works in the Political Department of the Second Artillery Corps.

84. See, for example, Zhang Jianzhi. Zhang is a specialist in the Second Artillery Corps.

85. "Pay Close Attention"; "Résumé of Discussions at the Ground Force Training Conference," in J. C. Cheng, p. 684.

第九章

1. See Simpson, *Independent Nuclear State*, especially Chap. 11.

2. Interviews with Chinese specialists, 1986.

3. *Ibid.*

4. Holloway, "Innovation," p. 403.

5. Quoted in Holloway, "Entering the Nuclear Arms Race," p. 188.

6. Gowing, *Independence and Deterrence* (U.K.); Hewlett and Anderson

(U.S.); Rhodes (U.S.); Irving (Germany); Goldschmidt, pp. 121-52 (France). As of this writing, the principal sources on the Soviet program are Golovin; Kramish; Modelski; Holloway, "Entering the Nuclear Arms Race," pp. 159-97; and Holloway, "Military Technology," pp. 451-55.

7. Gowing, *Independence and Deterrence*, 2: ix. The classic treatment of Great Britain's wartime atomic program is Gowing, *Britain and Atomic Energy*.

8. Cockcroft headed the Montreal atomic energy laboratory, a joint Anglo-Canadian-French facility that worked on the chemical separation of plutonium. Penney, a mathematician and an expert on explosive effects, was a member of the British team at Los Alamos. Gowing, *Independence and Deterrence*, 2: 4-7.

9. For example, Zhao Zhongyao, a physicist who later worked at the Institute of Atomic Energy, witnessed at least one of the U.S. Bikini atoll tests in the late 1940s. However, Zhao was not a major participant in the Chinese nuclear weapons program.

10. The Soviet Union exploded a fission weapon in 1949, the British in 1952, the French in 1960, and the Chinese in 1964. The initial fusion weapons tests came in this order: United States, 1952; the Soviet Union, 1953; the United Kingdom, 1957; China, 1967; and France, 1968.

11. Gowing, *Independence and Deterrence*, 2: 497.

12. Quoted in Chap. 1, p. 1.

13. Irving, p. 267.

14. The information in this paragraph is based on Holloway, "Entering the Nuclear Arms Race," pp. 166-70.

15. Gowing, *Independence and Deterrence*, 2: 502.

16. Gowing, *Reflections on Atomic Energy History*, pp. 9-22.

17. Holloway, "Innovation," p. 394.

18. *Ibid.*, pp. 389-91; Holloway, "Military Technology," pp. 451-55.

19. United States, President's Blue Ribbon Commission, pp. 11-13.

20. For a discussion of *zongjie*, see J. Lewis, *Leadership*, pp. 160-62.

21. NRH, p. 840.

22. NRH, p. 796.

23. NRH, p. 822. The quotations in the next paragraph are from the same page.

24. Nie Rongzhen, "How China Develops Its Nuclear Weapons," pp. 15-16.

25. NRH, p. 787.

26. NRH, p. 814. In the Chinese idiom, the seven daily necessities are fuel, rice, oil, salt, soy sauce, vinegar, and tea.

27. NRH, p. 821.

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对于报刊上的文章，没有给出汉语拼音。除了两个频繁引证的刊物——*Renmin Ribao*（《人民日报》）和 *Liaowang*（《瞭望》）外，对于所有的报刊，都在方括号内给出其英文名称。参考文献利用了下列缩略语：

FBIS：*Foreign Broadcast Information Service*（外国广播新闻处）；

JPRS：Joint Publication Research Service（联合出版物研究处）；

NRH：*Nie Rongzhen Huiyilu*（《聂荣臻回忆录》）。

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