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Panel Session I - The Chinese Space Program: Space Wei Qi

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THE CHINESE SPACE PROGRAM: Space Wei Qi
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DILEMMA OF DUAL-USE TECHNOLOGY

CHINA'S AMBITIOUS SPACE ACTIVITIES
• November 2000 White Paper
• "The Chinese government attaches great importance to the significant role of space activities in implementing the strategy of revitalizing the country with science and education and that of sustainable development, as well as in economic construction, national security, science & technology development and social progress. The development of space activities is encouraged and supported by the government as an integral part of the state's comprehensive development strategy."

FAST APPROACH OR PRUDENT APPROACH?
• US precursor missions = about 21 / Chinese 4
• China started much further up the learning curve / learn from others
• China bought hardware from Russia (life-support, reentry)
• Alarm system for debris, automatic fault detection & escape system...

LEARNING FROM OTHERS... OR NOT REINVENTING THE WHEEL

Xichang Launch Site = 28 degrees N latitude
KSC = 28.5 degrees N latitude
SATELLITES

• Mao 1/China 1 — April 24, 1970, "The East is Red"
• Over 50 satellites with > 90% success rate
  - Multiple launch capability since 1981
• Military
  - Communications – January 2000
  - Fanshui Shi Weixing (FSW) recoverable photo-reconnaissance
• Remote Sensing – Ziyuan (ZY), "resource"
  - CBERS-1 or ZY: China-Brazil
  - ZY-2 (2002/3) High-resolution electro-optical imaging satellites (resolution about 3 meters)
    - Jianbing-3 "Pathfinder"
  - Radar remote sensing satellite development

COMMERCIAL LAUNCH INDUSTRY

• Long March (Great Wall Industry Corporation)
• Hard Currency (mid 1980's)
• Series of launch accidents in the 1990's
  - Cox Committee
  - U.S. export laws
• Launch Insurance
• 30+ consecutive successful launches since 1996

SATellites

WHAT: LAUNCHERS

• Long March family of launchers – derived from Dong Feng missile
  - Analogy with development of workhorses of U.S. commercial launch fleet: Atlas, Delta and Titan
• Manned Launches – LM/CZ-2F
• 9/24/03 test-fire of first 4 stage solid-fuel launch vehicle (100-kg satellites)

LAUNCH SITES

• Jiuquan Satellite Launch Center
  Gobi Desert in Gansu Province, NW China, launches all recoverable satellites (Inner Mongolia recovery site)
• Xichang Satellite Launch Center
  Sichuan Province. GEO satellites (only center which can accommodate cryogenic upper stage)
• Taiyuan Satellite Launch Center.
  Shanxi Province. Polar orbits.

SATELLITES

• Weather – Fengyun (FY)/ “Wind and Cloud” >6 for Olympics
• Communications – Dongfanghong (DFH)/ “East is Red”
  - Moving to C, Ku, KA, And L band transponders
• Oceanography – Haiyang (HY) “Ocean”
• Microgravity – Shijian (SJ) “Practice”
• Science/Astronomy
  - Double Star – 2003 with ESA –effects of the Sun on the Earth’s environment (5 ESA sensors)
• Navigation – Beidou “Twin Star”
  - 4 total/2 launched in 2000/3rd in 2003
  - EU Galileo program
PROJECT 921: MANNED PROGRAM

- Second (third) attempt
- Money determines timetable as much as technology
- 14 Taikonauts (2 trainers)
  - (Yuhangyuans in Chinese)
  - Women to be recruited in 2005

SHENZOU MISSIONS

- 1996 announcement of 1999 manned launch (commemorate 50th anniversary of founding of Communist State)
- Nov 1999 Shenzhou I (unmanned)
- January 2001 Shenzhou II (unmanned)
- March 2002 Shenzhou III (unmanned)
- January 2003 Shenzhou IV (unmanned)

SOYUZ/SHENZOU

Soyuz A

Shenzhou

SHENZOU

- Differences
  - Second set of solar panels
  - Larger
  - Propulsion, control & guidance improvements
- Design
  - Forward module holds experiments/docking crew transfer module
  - Potential Space Station piece
  - Manned Module
  - Rear Service Propulsion system

TAIKONAUT TRAINING

- Star City, Russia
  - Li Qinlong & Wu Zi
  - EVA training
- Chinese Center North of Beijing
  - Secrecy
  - Families employed

YANG LIWEI
REORGANIZATION
- Aerospace: From pure, central-economy run program to internationally competitive enterprise
  - Balance
    - Jobs
    - Efficiency
    - Competition/Cooperation
    - Politics
    - Military Control/Civilian Control as International Requisite
- General Cao Gangchuan: Was head of the General Armaments Department of the PLA, member of the Central Military Commission (CMC) & Director of the Manned Spacecraft Program – Now the Chinese Defense Minister
- General Li Jinai: Chief Commander of China’s Space Program

WHY: APOLLO ANALOGY
- Goals of the Apollo Program
  - Beat the Russians/Cold War “Battle”
    - Prestige
      » Sputnik shock
    » Domestic & Foreign (Regional) Benefits
  - Technology Gap
  - Economics
    - Jobs (political and economic benefits)
  - Military

PRESTIGE
- Domestic
  - Positive public “rallying” factor
  - Governmental legitimacy (a la Olympics)
- Regional/International
  - Prestige/influence – Pakistan & Iran
  - Third country with manned space capabilities

TECHNOLOGY GAP/ECONOMICS, EDUCATION...AND POLITICS
- Educational Programs
- Labor force skilled in technology jobs
- Government spending creating technical jobs
- Communication to Western China
TECHNOLOGY GAP/ MILITARY

- Developing military space technology through a manned program is the most expensive, least efficient way to do so
- However, there is no doubt that benefits accrue
  - Shenzhou a reconnaissance platform?
  - Zi Yuan (ZY) 2 photo reconnaissance satellite launched 10/02 "military" version of ZY 1, developed as China-Brazil Earth Resource Satellite (also called Jianbing 3)
    - Intl Cooperation Example
    - Japanese Information Gathering System (IGS)

MANNED TO

- Tracking
  - TT&C = 8 domestic tracking sites, one in Kiribati, 1 in Naminia, & 4 Yuanwang class tracking ships
  - S-band expansion/improvements (tracking GEO sats)
- On-orbit maneuvering
- Mission management
- Launch-on-demand
- Miniaturization (less weight)
- Computational analysis

FUTURE SPACE RACE?

- Seeking parity with US? NO
  - May 2003, Council on Foreign Relations: China is at least two decades behind the US in military technology and ability
- U.S.-China action-reaction YES
  - Both countries see space as so vital to their futures, that actions by one seen as zero-sum to the other

SPACE SPENDING: NASA COMPARISON

- Apollo @ $25 Billion
- NASA/$15 Billion
- China @ between $1.4 and $2.2 Billion
- Apples & Oranges Comparison
  - Currency Conversion
  - Command Economy
  - Deliberate Over-Employment

PROGRAMMATIC SPENDING

- Galileo
  - $259 Million, to cooperate with technical, manufacturing and market development
- Chang’e
  - First phase = Moon rover @ $170 M
**FUTURE PLANS**

- Phased, incremental, cautious, ambitious
- 20 - 70 ton life capability
- Liquid oxygen/kerosene engines to replace the UDMH (Unsymmetrical DiMethyl Hydrazine) currently used
  - Poisonous and highly volatile

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**SPACE WEI QI**

- ISS
  - Docking Ring
  - State Space Robot Project Research Center
    - Space robot “Mister E”
  - Harbin Industrial University
    - “Space Hand”
- New US Space Vision
  - Inclusion of China politically improbable
  - Cooperative Programs without the US

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**CHINA’S SPACE PROGRAM**

- China’s determination to regain what it considers as its deserved place in global, and by default, regional politics
- Win-Win investment as long as there are no catastrophic failures
- Minimize the Technology Gap with US

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**FUTURE PLANS**

- Taikonaut
  - 2ND Launch in 2005 - 2 taikonauts for 5-7 days
- Space Laboratory (2 modules)
- Lunar program – Chang’e
  - Moon landing in 2010, then polar-like base
  - Vehicle program by 2020
  - Sustained program vice Apollo
  - Energy Resources
- Manned Lunar Program – expected (2020?)
- Mars 2040

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- The Chinese Space Program: Sun Tzu or Apollo Redux (Summer 2003)
- Space Wei Qi: The Launch of Shenzhou V (Spring 2004)
- “Houston, We Have A Problem:” China and the Race to Space
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