

~~To Be Mailed~~

STAY

GETTING THERE

0 REUSABLE LIFT T/A

STAYING THERE

TAV

GETTING THERE

REUSABLES

OPERATING THERE

MODULAR SYSTEMS

1

STAYING THERE

o TAV

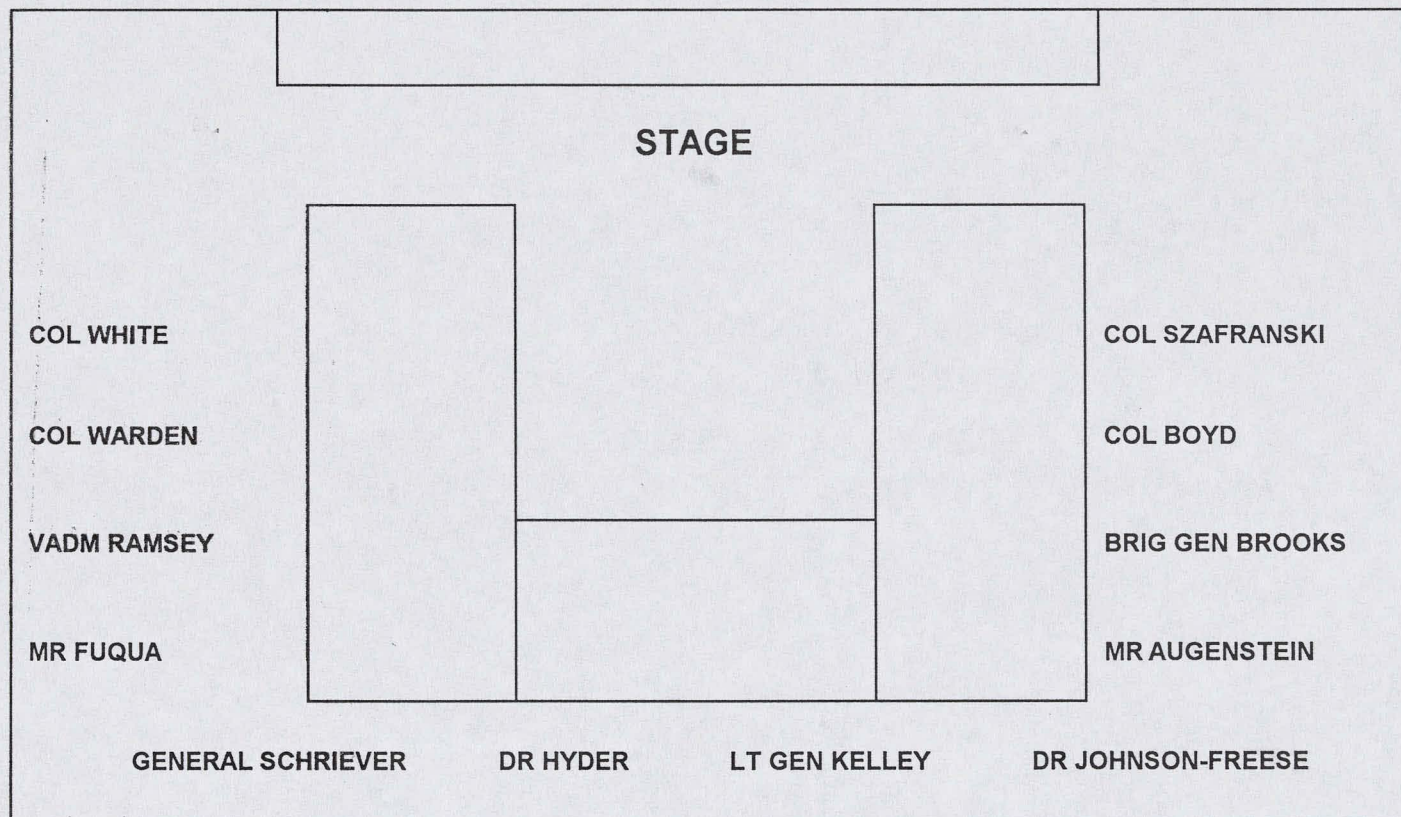
o

A CLOSER LOOK

○ STAYING THERE

○

SPACECAST 2020 ADVISORY GROUP SEATING CHART FOR 31 MARCH



SPACECAST 2020 ALTERNATE FUTURES

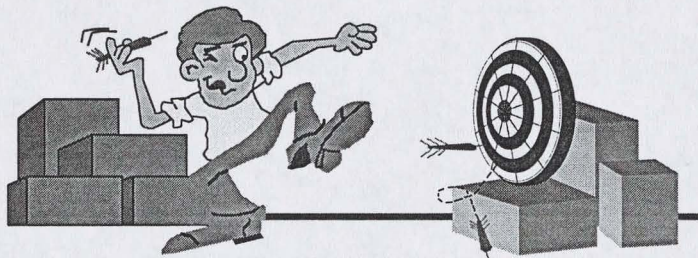
The Worlds of 2020

... and Beyond ...

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Long-Range Strategic Planning & the SPACECAST 2020 Challenge

How best do I set goals and strategies and identify innovative concepts and technologies that will remain viable in an environment of rapid and *fundamental* change?



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SPACECAST 2020 Approach

- ☐ Educate bright officers with varied backgrounds about the future, creativity, and space;
- ☐ Develop a vision of the future as a backdrop for creative Space concept development;
 - ☐ Consensus "World View" highlights challenges of a most likely future;
- ☐ Seek wide input of technologies for potential future application;

and . . .

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**Develop & Assess SPACECAST Concepts
and Technologies within the Context of
Alternative Future Worlds to Highlight High
Leverage Ideas and to Bound Risks**

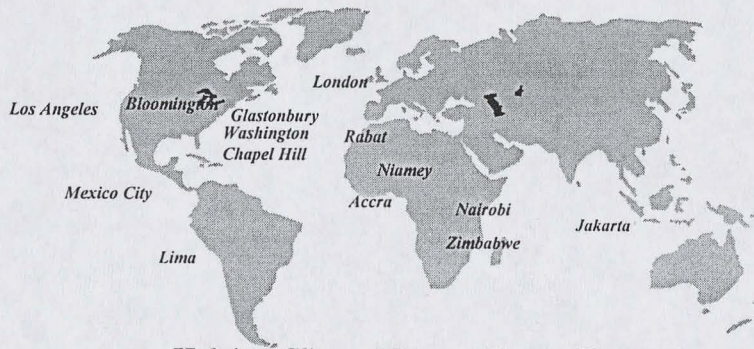


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SPACECAST 2020 &

The Futures Group

An International Strategy & Consulting Firm



Helping Clients Manage Future Uncertainty

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Scenarios . . .

**Are Descriptions of Future Conditions Intended
for Use as a Background for Planning and
Assessing Alternative Strategic Courses of Action**

- Describe a plausible evolution of events and trends
- Present, as a set, the range of possibilities central to your organization
- Include projections of important events and trends

Are *Not* Forecasts of What Will Be

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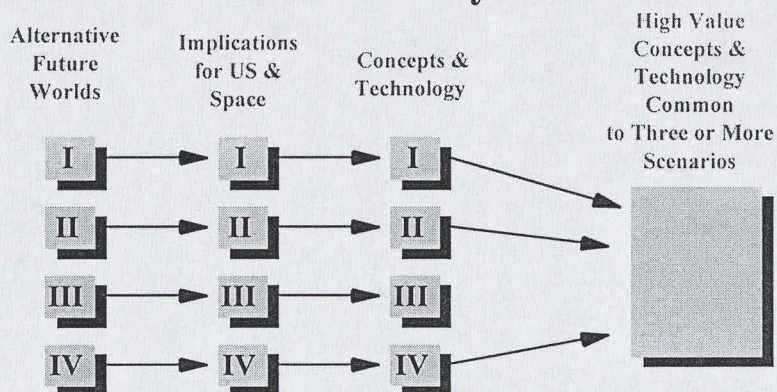
Requirements for Scenarios

- ✓ Together Must Capture the Breadth or Range of Future Challenges/Opportunities
- ✓ Must Logically Extend from Today
- ✓ Must Be Internally Consistent

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THE
FUTURES
GROUP

Scenario Study Model



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Building the SPACECAST 2020 "Scenario Space"

Nominated Drivers

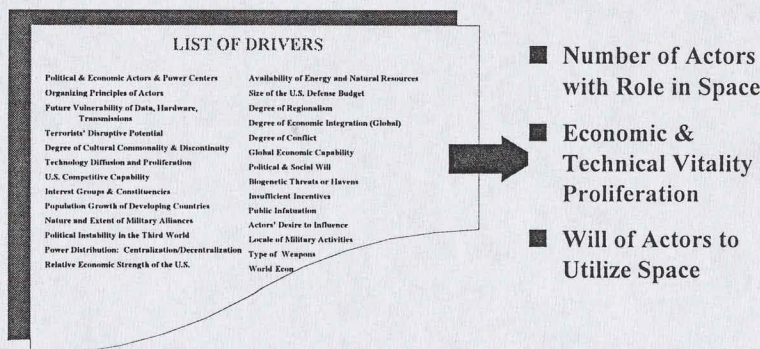
Political & Economic Actors & Power Centers	Availability of Energy and Natural Resources
Organizing Principles of Actors	Size of the U.S. Defense Budget
Future Vulnerability of Data, Hardware, Transmissions	Degree of Regionalism
Terrorists' Disruptive Potential	Degree of Economic Integration (Global)
Degree of Cultural Commonality & Discontinuity	Degree of Conflict
Technology Diffusion and Proliferation	Global Economic Capability
U.S. Competitive Capability	Political & Social Will
Interest Groups & Constituencies	Biogenetic Threats or Havens
Population Growth of Developing Countries	Insufficient Incentives
Nature and Extent of Military Alliances	Public Infatuation
Political Instability in the Third World	Actors' Desire to Influence
Power Distribution: Centralization/Decentralization	Locale of Military Activities
Relative Economic Strength of the U.S.	Type of Weaponry Available
	World Economic Conditions

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Building the SPACECAST 2020 Scenario Space

- Drivers Merged and Collapsed into Dimensions of Broader, More Universal Scope



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Dimension Variability Selected

Dimensions

Number of Actors
with Space Role

Many  Few

"Technomic" Vitality
Proliferation

High  Low

Actors' Will to Use Space

Strong  Weak

Three Dimensions Varied to the Extremes,
Yield Eight Possible Future Worlds to Explore

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Building the SPACECAST 2020 "Scenario Space"

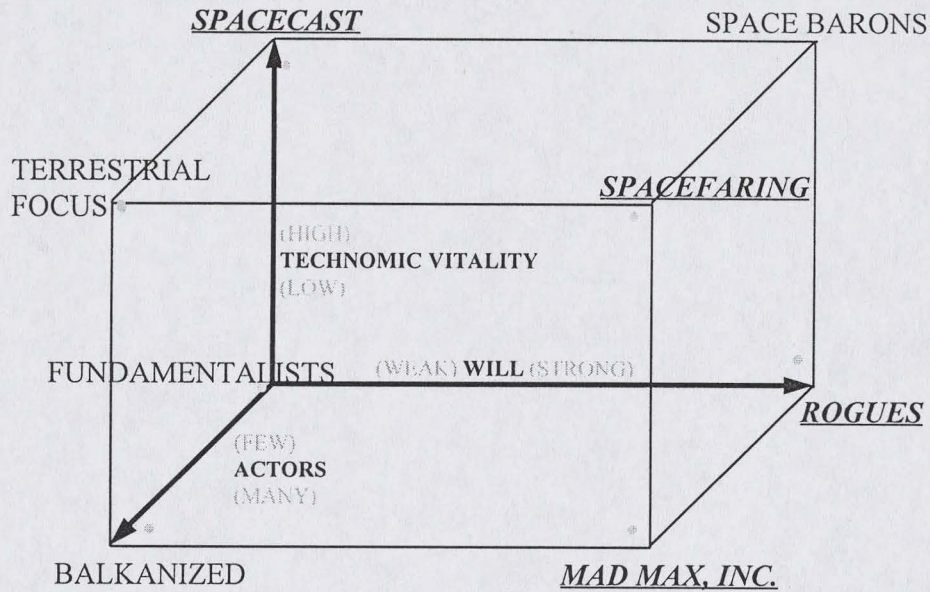
Alternative Scenarios

No. Actors with Space Role	Technomic Vitality	Will to Use Space	
①. Many	High	Strong	(SPACEFARING)
2. Many	High	Weak	(TERRESTRIAL FOCUS)
③. Many	Low	Strong	(MAD MAX, INC.)
4. Many	Low	Weak	(BALKANIZED)
5. Few	High	Strong	(SPACE BARONS)
⑥. Few	High	Weak	(SPACECAST)
⑦. Few	Low	Strong	(ROGUES)
8. Few	Low	Weak	(FUNDAMENTALIST)

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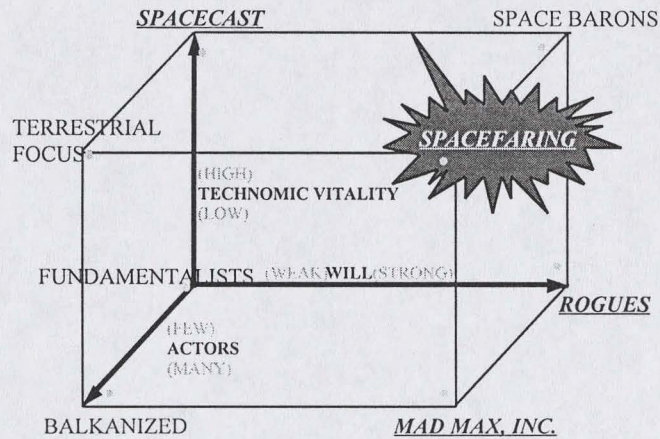
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ALTERNATE WORLDS OF 2020

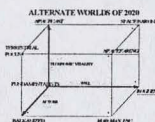


SPACEFARING WORLD

ALTERNATE WORLDS OF 2020



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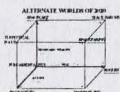
SPACEFARING WORLD

(A PLAUSIBLE HISTORY)

- Advances in comm/info interconnectivity and success of GATT led to a highly interdependent "global village"
- Few remaining rogue states were swept away by dual waves of *glasnost* and economic opportunity
- Competitive atmosphere led to early development of advanced space launch methods
- Fierce (but somewhat friendly) economic competition extended into the space realm
- Cheap, reliable spacelift became available from a variety of sources (nation-states, corporate barons, etc.)
- Military assumed role of policeman and space traffic controller
- Entertainment & education increasingly used a space setting

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SPACEFARING WORLD

ACTORS

Players/ NonPlayers
Gov/ Entrepreneurs Role

TECHNOMIC VITALITY

Economic
Priorities
Technologies
Proliferation
Energy
Information
Education

WILL/ INVOLVEMENT

Motivations
Threats
Econ Pressures
Imagination
Political Leadership
Social Structure

MANY

Governments are Only One of Many Actors; Individuals, Transnationals, Supranationals active in Highly Competitive, Dense, Stable, Interdependent Environment

HIGH

Free Trade-Global Industrial Policy; Space Investment is Economic Reality; Wide Econ Opportunity

Global Technology Proliferation: Space Surveillance, Communications, Cellular Info Net

Cheap, prolific Advanced Propulsion

Global, cheap education & info services

STRONG

Some Cooperation in Planetary Defense (Asteroids...)

Great Econ Opportunities & Growth

High Imagination - Space visionaries & entertainers; Space 'tourism' under development

Political Leadership encouraging growth; Adherence to Space Law; Strong Space Constituent Groups

Decentralized social structures with sophisticated Social Support Services

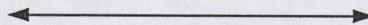


SPACEFARING WORLD

NATURE OF SPACE

PROLIFERANT, GLOBAL, EXPANDING

MILITARY SPACE



Relative Military Role

Counterforce

Low (3) [Deconfliction] [Potential Planet Defense]

Logistics

Low (3)

Monitoring & Reporting

Moderate (5) [Dual Use Expanding]

CIVIL/GOVERNMENT
ROLES

VERY HIGH

Level of Civ/Gov Activity

High (7)

Level of Commercial

Very High (10)

LIFT

Cost/Lb Cheap; Abundant Commercial Lift
[Helium 3, Nuclear Powered]

HUMANS IN SPACE

COMMON PLACE [Hotel/Station]

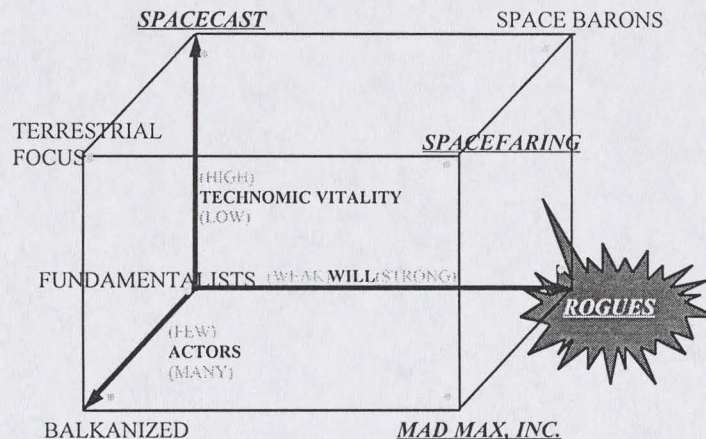
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Activity Rated 1-10 Comparing Worlds

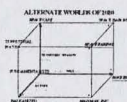
ROGUE STATE(S) WORLD

ALTERNATE WORLDS OF 2020



SPACECAST 2020

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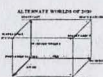
ROGUE STATE(S) WORLD

(A PLAUSIBLE HISTORY)

- Failure of GATT spawned era of neo-protectionism and world economic downturn
- Fundamentalistic Islamic states became closed, highly controlled societies in quest for "cultural purity"
- Advances in comm/info interconnectivity failed to overcome deep-seated prejudice and traditional cultural barriers
- More than one rogue state developed reliable indigenous spacelift, a demonstrated ASAT capability, and willingness to violate space law
- Perceived threat brought renewed US emphasis on space defense, increased military role in space

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ROGUE STATE(S) WORLD

ACTORS

Players/ NonPlayers
Gov/ Entrepreneurs Role

TECHNOMIC VITALITY

Economic
Priorities
Technologies
Proliferation
Energy
Information
Education

WILL/ INVOLVEMENT

Motivations
Threats
Econ Pressures
Imagination
Political Leadership
Social Structure

FEW

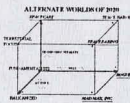
States & Pol Actors with Dictator or Ideological State seeking Influence; Few Entrepreneurs; Shifting Allies

LOW

Tiered, shifting Economies; Protectionist; Embargoes
Domestic Needs Sacrificed to National Security
Emphasis on Reliable, Indigenous Technology
Little advanced propulsion; High Military Lift
Expensive, Dispersed; Fiber Optics controlled by State
Irregular Education

STRONG

Threat of Ideological/Religious WMD from Space
Scarce Resources
Strong Responses to Perceived Threats
Political Leadership is Key; Rogue Violating Space Law
Multipolar; Varied Regimes, some Totalitarian



ROGUE STATE(S) WORLD

NATURE OF SPACE

LIMITED - CRITICAL

MILITARY SPACE

Relative Military Role

Counterforce

Logistics

Monitoring & Reporting

Very High (8-9) [ASAT]

Moderate (5)

High (8)

CIVIL/GOVERNMENT ROLES

LOW

Level of Civ/Gov Activity

Very Low (1)

Level of Commercial

Low (1-2)

LIFT

Cost/Lb Slightly More Expensive; Gov Dominated
[SzeChuan 6]

HUMANS IN SPACE

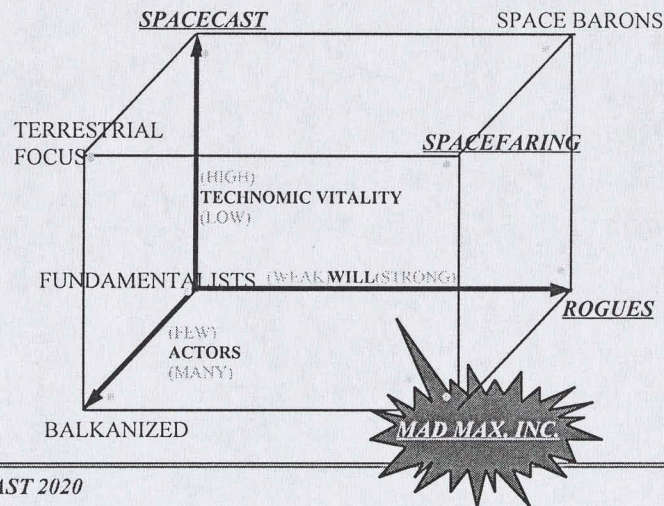
No- Low

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Activity Rated 1-10 Comparing Worlds

MAD MAX, INC. WORLD

ALTERNATE WORLDS OF 2020



SPACECAST 2020
1 April 1994



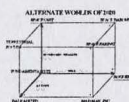
MAD MAX, INC. WORLD

(A PLAUSIBLE HISTORY)

- Small nuclear exchange (not involving U.S.) and resultant environmental nightmare occurred in South Asia
- Devastating earthquake in California decimated US economy and led to mass internal migrations
- Post-industrial states shifted to social programs, environmental cleanup, disaster relief, and enacted complex regulatory environment
- Multinational corporations (MNCs), quicker to recover than nation-states, filled void by privatizing many other former public sector tasks
- "Corporate think" and individual economic concerns led to decreased clout for nation-states and further rise of MNCs
- Many military forces--including space assets--were increasingly made available to the highest bidder

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MAD MAX, INC. WORLD

ACTORS

Players/ NonPlayers
Gov/ Entrepreneurs Role

TECHNOMIC VITALITY

Economic
Priorities
Technologies
Proliferation
Energy
Information
Education

WILL/ INVOLVEMENT

Motivations
Threats
Econ Pressures
Imagination
Political Leadership
Social Structure

MANY

Corporations are Drivers; Governments are Welfare States; Highly Regulatory Environment with Complex Political-Legal Interconnectivity

LOW

High, Shifting internal Corp Resource Allocation; Moderate Trade; Corporations pursuing Profit; States focused on Domestic Needs
Technology Proliferation Irregular
Limited advanced propulsion; Some Corporate Lift
Irregular; State provided Basic; Sophisticated Corporate Info Net; Info Security (Econ) Prime
State provided Basics; Corp Educational-Training Feudal Universities

STRONG

Space a Corporate Haven from Regulation
Resource & Energy Opportunities in Space
Political & Social Space Vision Lost; Corporations seek Niches
Political Leadership domestically focused
Regulated Earth, Corporations Transcend some Social Structures



MAD MAX, INC. WORLD

NATURE OF SPACE

MILITARY SPACE

Relative Military Role

Counterforce

Logistics

Monitoring & Reporting

CIVIL/GOVERNMENT ROLES

Level of Civ/Gov Activity

Level of Commercial

LIFT

HUMANS IN SPACE

COMMERCIAL FOCUS



Very Low (1) [Corporate]

Very Low (1) [Commercially Driver]

Moderate (4) [Dual Use]

LOW - MODERATE

Low (2)

High (9)

Cost/Lb Lower; Commercial Lift
[Delta Clipper 3]

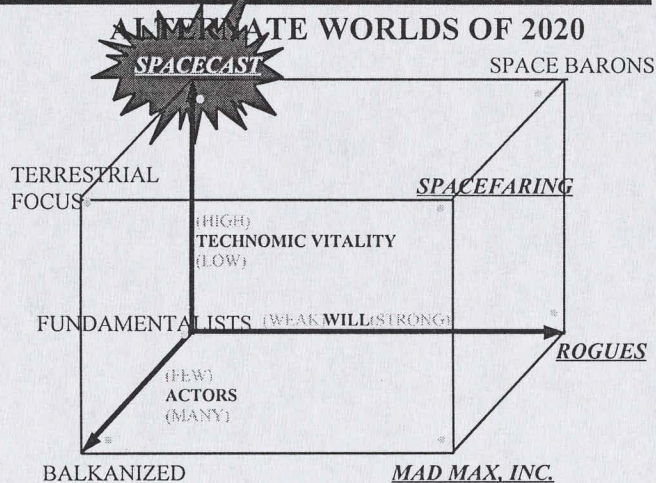
MODERATE

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1 April 1994

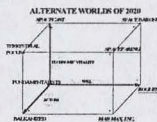
Activity Rated 1-10 Comparing Worlds

SPACECAST & SPACE BARONS



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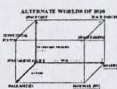
SPACECAST & SPACE BARONS

(A PLAUSIBLE HISTORY)

- States avoided World War III, although a single nuclear incident occurred prior to 2020
- Nation-states shifted from military to economic competition
- Increasingly Wealthy Northern Nations formed several pragmatic alliances and consortia which widened the gulf between "haves" and "have-nots"
- High-tech alternative terrestrial solutions such as fiber optics slowed the drive to develop advanced space systems
- Lack of political leadership and popular support opened a window of opportunity to semi-reluctant "space barons" (e.g., Motorola, Microsoft, CNN)

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SPACECAST & SPACE BARONS

ACTORS

Players/ NonPlayers
Gov/ Entrepreneurs Role

TECHNOMIC VITALITY

Economic
Priorities
Technologies
Proliferation
Energy
Information
Education

WILL/ INVOLVEMENT

Motivations
Threats
Econ Pressures
Imagination
Political Leadership
Social Structure

FEW

States & Space Barons; US dominates, but no monopoly

HIGH

Regional and Transnational Economic Blocks;
Space Money subject to Budget Cuts; Mil/Civ Dual Use
Moderately Proliferated
Some advanced propulsion technology
Increasing LANs
Computer use helps integrate Education

MOD/LOW

A Few States concerned about Security Threats
A Few Space Barons seek Econ Niches & Profits
Hollywood not Evoking Space Images; No Exploration
Earth vs. Space Focus
Democratic and Multipolar



SPACECAST & SPACE BARONS

NATURE OF SPACE

STATUS QUO & BARONS

MILITARY SPACE



Relative Military Role

Limited (2)

Counterforce

Very Limited (1-2), Except Barons

Logistics

High (8)

Monitoring & Reporting

CIVIL/GOVERNMENT ROLES

LOW - MODERATE

Level of Civ/Gov Activity

Low (2)

Level of Commercial

Moderate (5)

LIFT

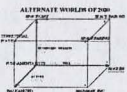
Cost/Lb Slightly Cheaper; Civ/Mil Cooperation

HUMANS IN SPACE

Low

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Activity Rated 1-10 Comparing Worlds



SPACECAST vs. SPACE BARONS

What are the Differences?

- Different Space Architectures
- Space Barons - Research & Development will produce Systems Without Concern about Hostile Conditions
- Space Barons - Degraded Continuous US Intelligence & Communications: Reduced Ability to Collect Against Non-Cooperative Targets

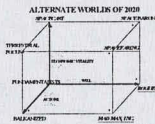
PRINCIPAL DIFFERENCE: "WHO OWNS?"

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ILLUSTRATIVE ANALYSIS

	SPACEFARING	ROGUE(S)	MAD MAX INC	SPACECAST (BARONS)
Trans- Atmospheric Vehicles	●	●	●	●
Omni- Spectral Sensors	●	●	●	●
Space Generated Holograms		●		●
Space- Connected RPV/UAV		●		●
Compact Toroid		●		●

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How SPACECASTERS Use Alternate Futures

CATs & RATs ask:

- ✓ Can we enrich our concept and technologies to enhance the payoff in each world?
- ✓ What implications does each world have on our concept and technologies?
- ✓ What implications do our concepts and technologies have on how the futures might evolve?
- ✓ How can our strategies for developing our concepts and technologies shape our desired future world?

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1 April 1994



**Briefing to the Advisory Group
31 March 1994**



SPACECAST 2020

Briefers

Lt Col Steve Malutich

Air War College

Class of 1994

Maj Greg Billman

Air Command and Staff College

Class of 1994



SPACECAST 2020

OVERVIEW

- *Recap of 24 January*
- *Accomplishments*
- *Remaining Work*



SPACECAST 2020

PURPOSE

- Envision what *capabilities* we will need in space
- Identify innovative *applications* of *space hardware* and *technology* that support those capabilities

IN THE INTEREST OF NATIONAL SECURITY



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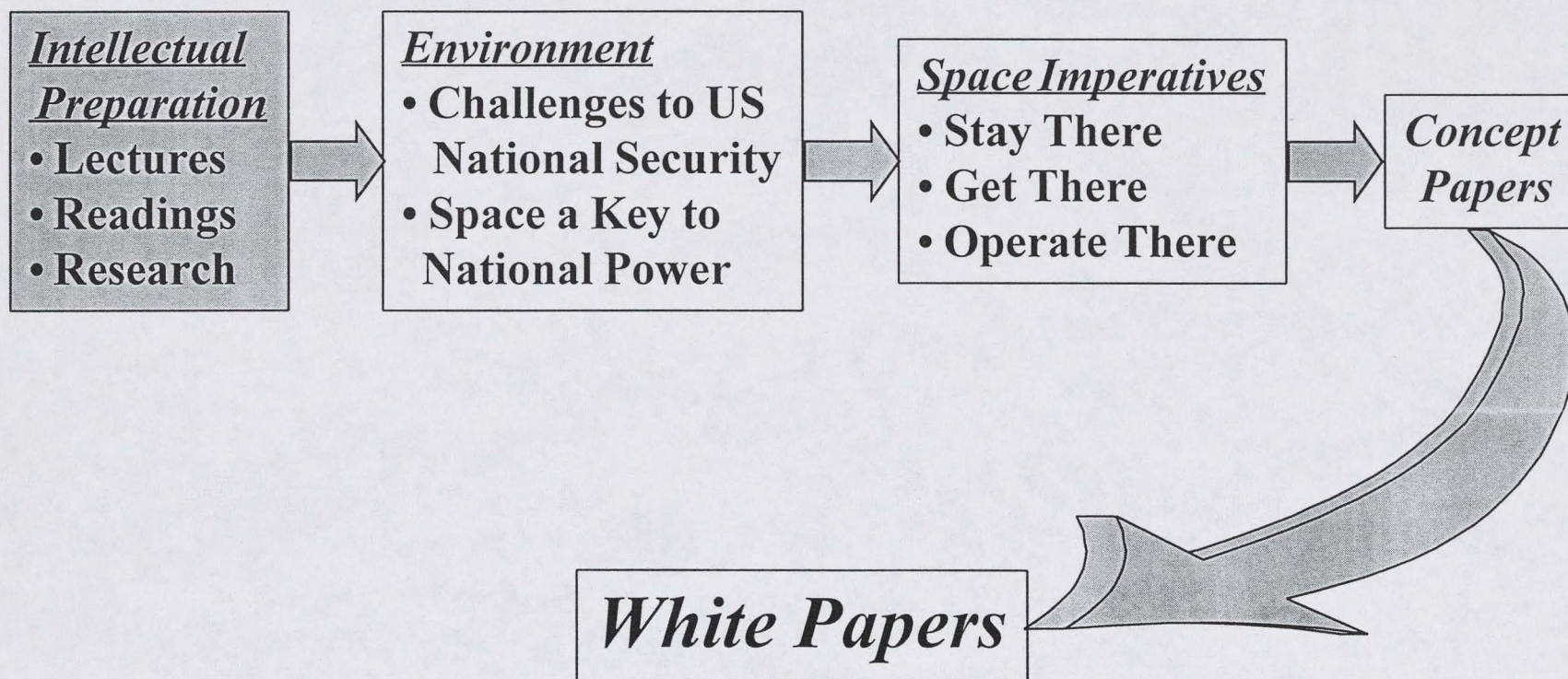
RULES OF ENGAGEMENT

- **Roles and missions independent**
- **Not constrained by existing doctrine, policy, or treaties**
- **Not bounded by programmatic**
- **Focus on concepts for 2020 and beyond**



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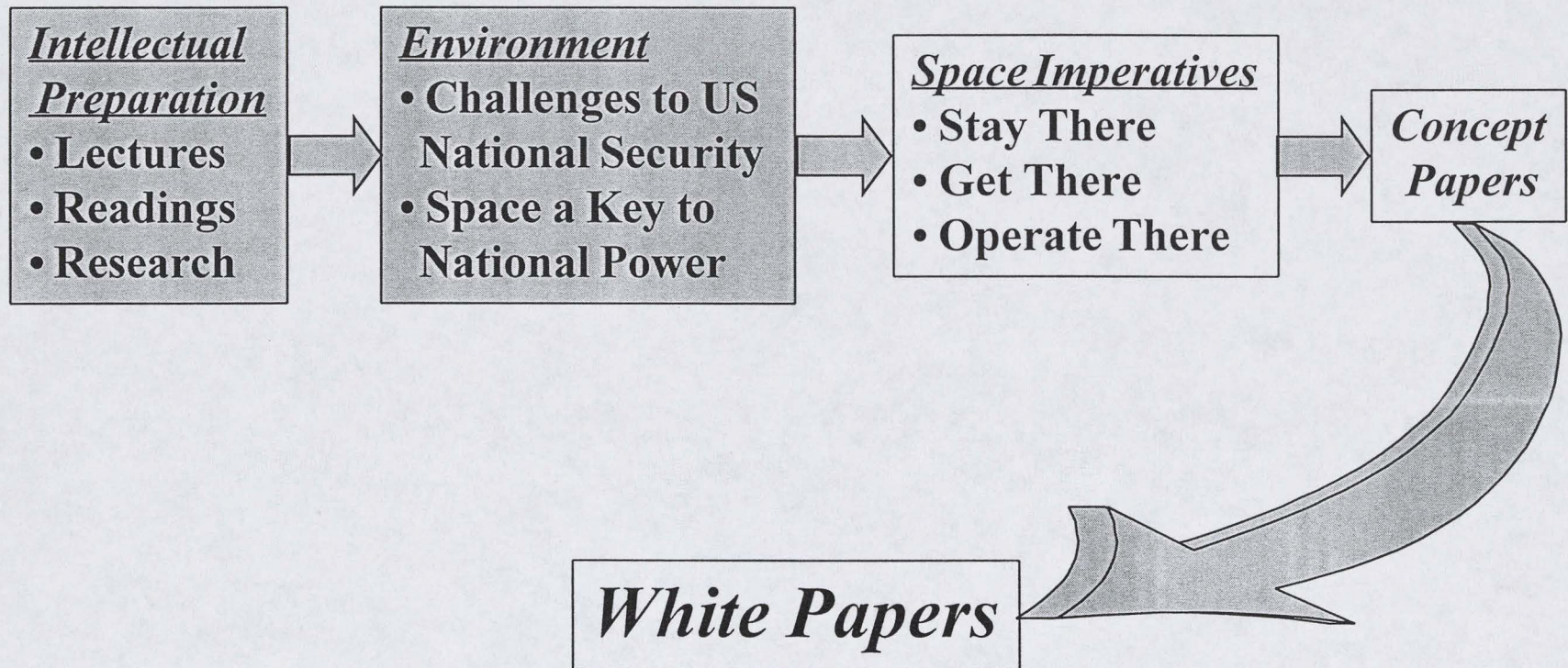
Process Through Last
Advisory Group Review





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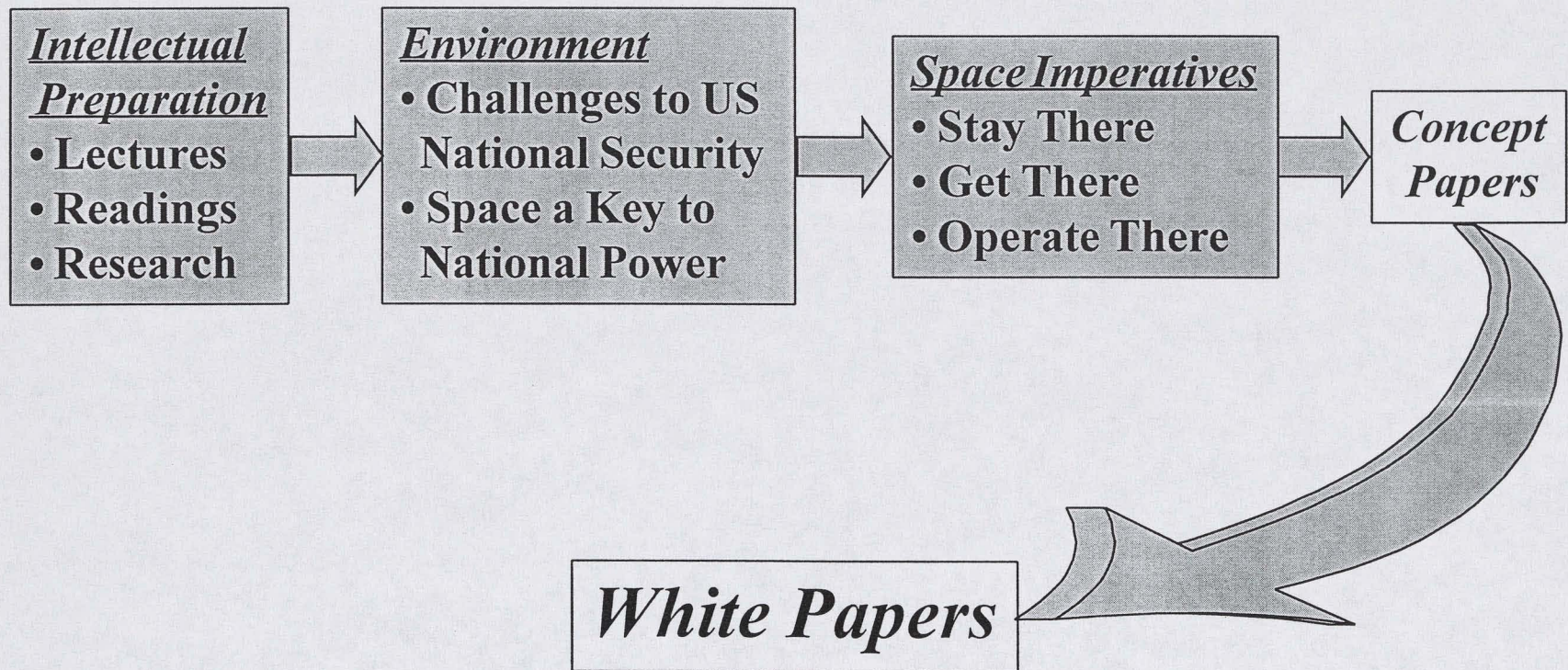
Process Through Last
Advisory Group Review





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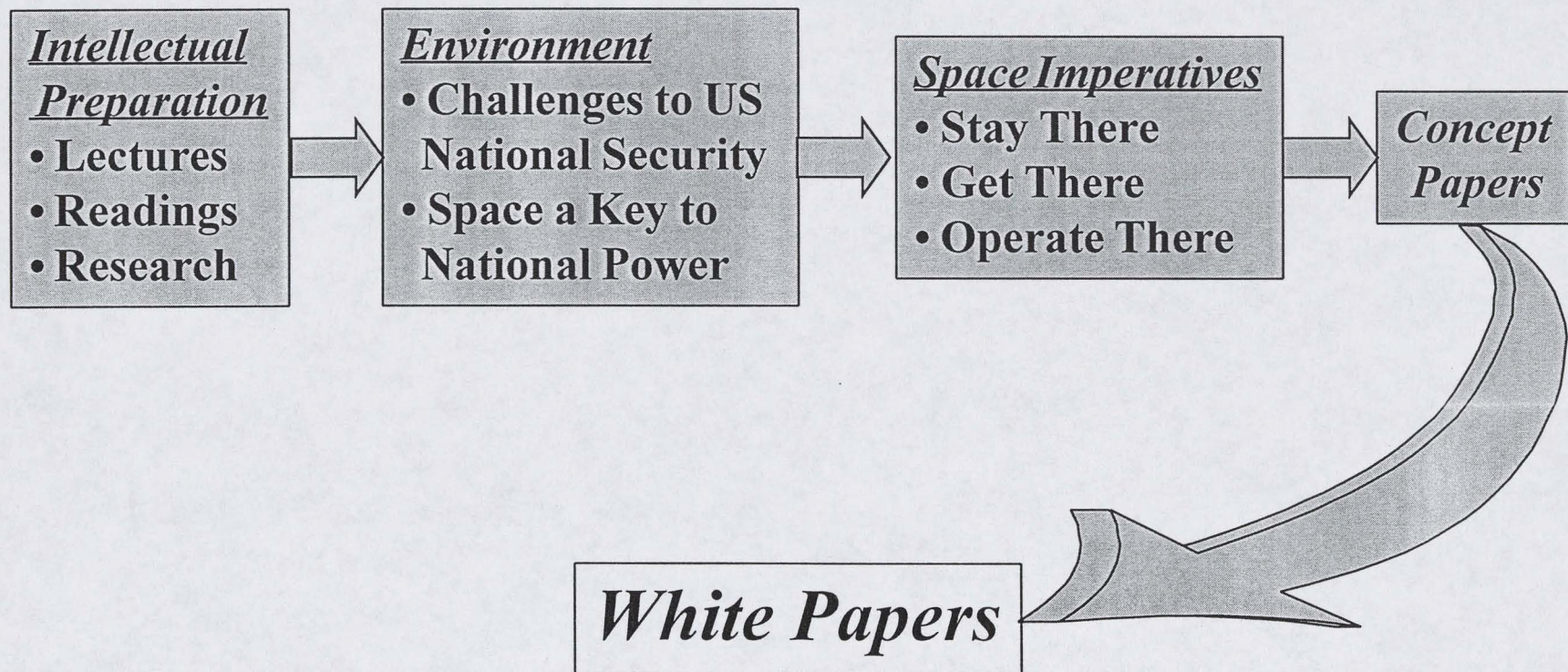
Process Through Last
Advisory Group Review





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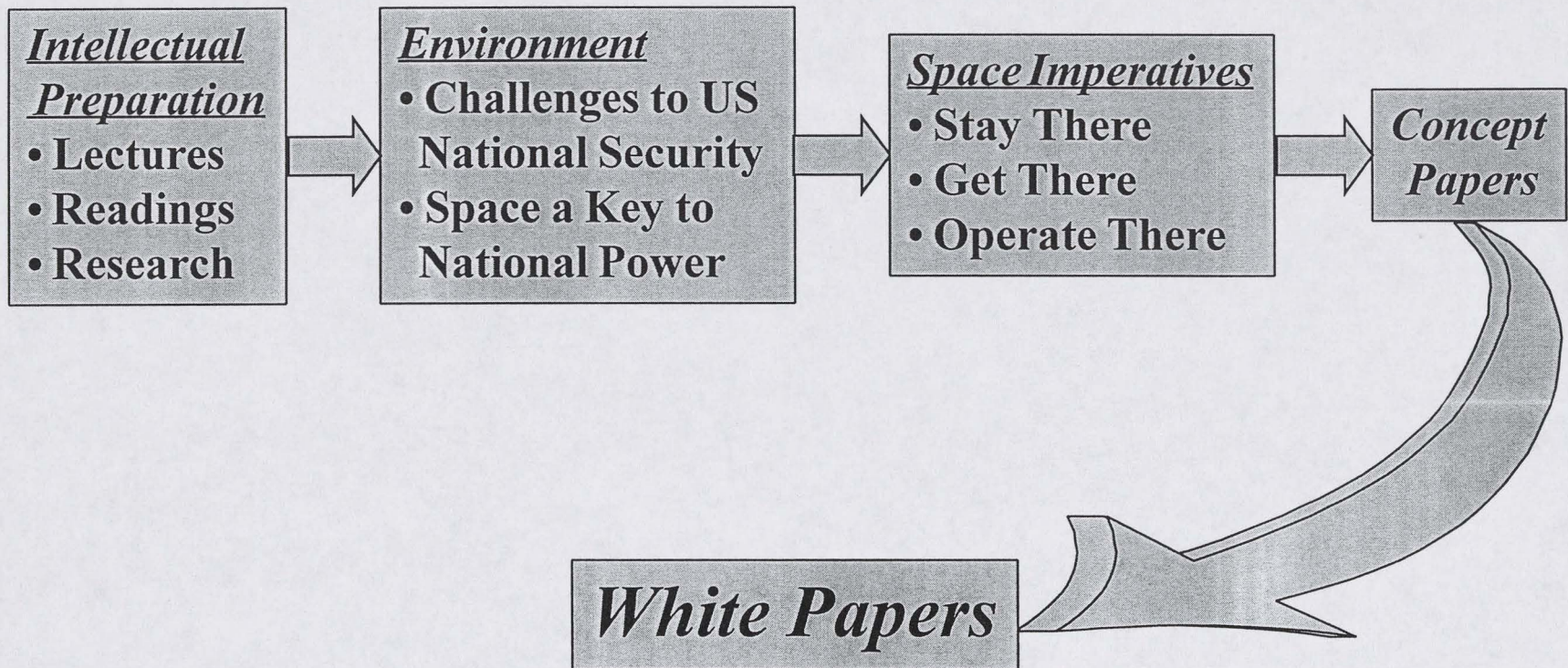
Process Through Last
Advisory Group Review





SPACECAST 2020

**Process Through Last
Advisory Group Review**





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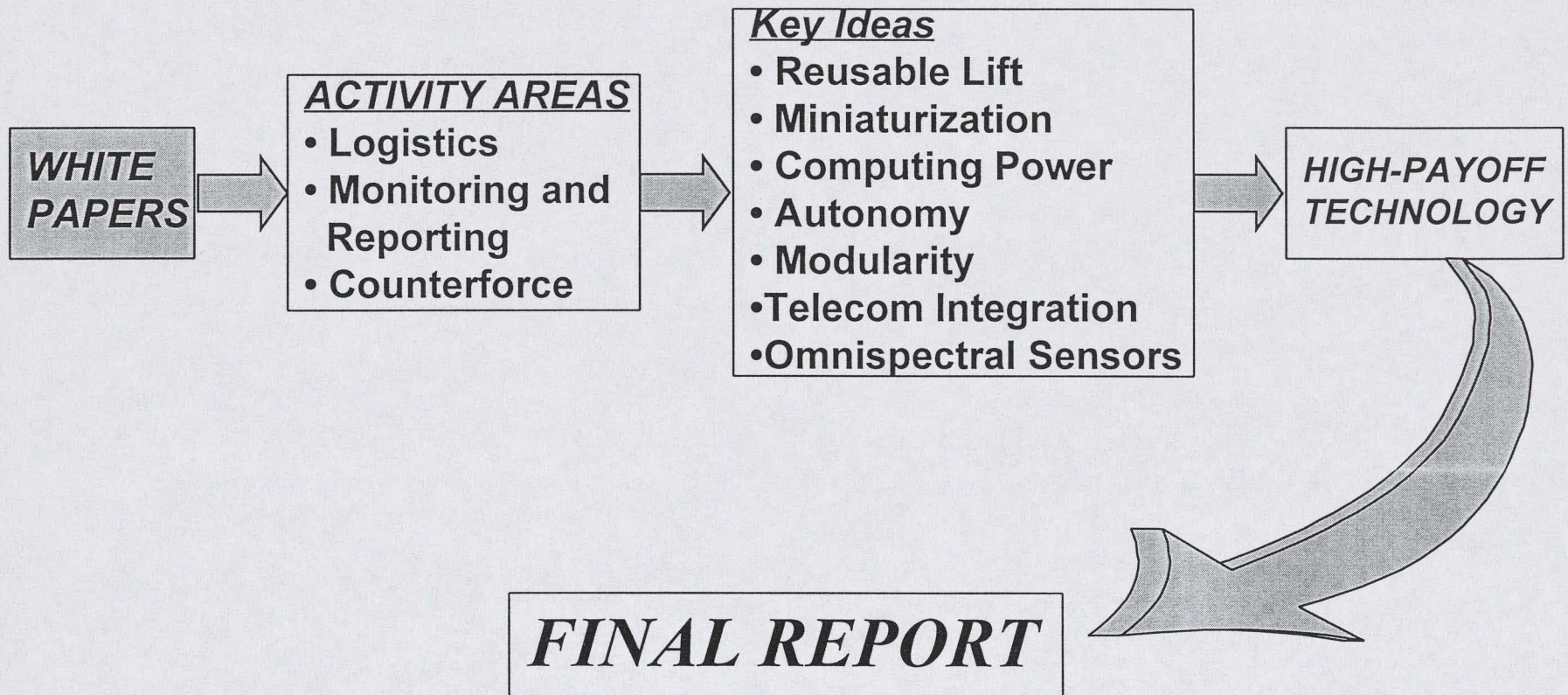
OVERVIEW

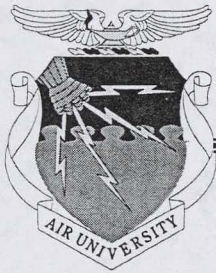
- *Recap of 24 January*
- *Accomplishments*
- *Remaining Work*



SPACECAST 2020

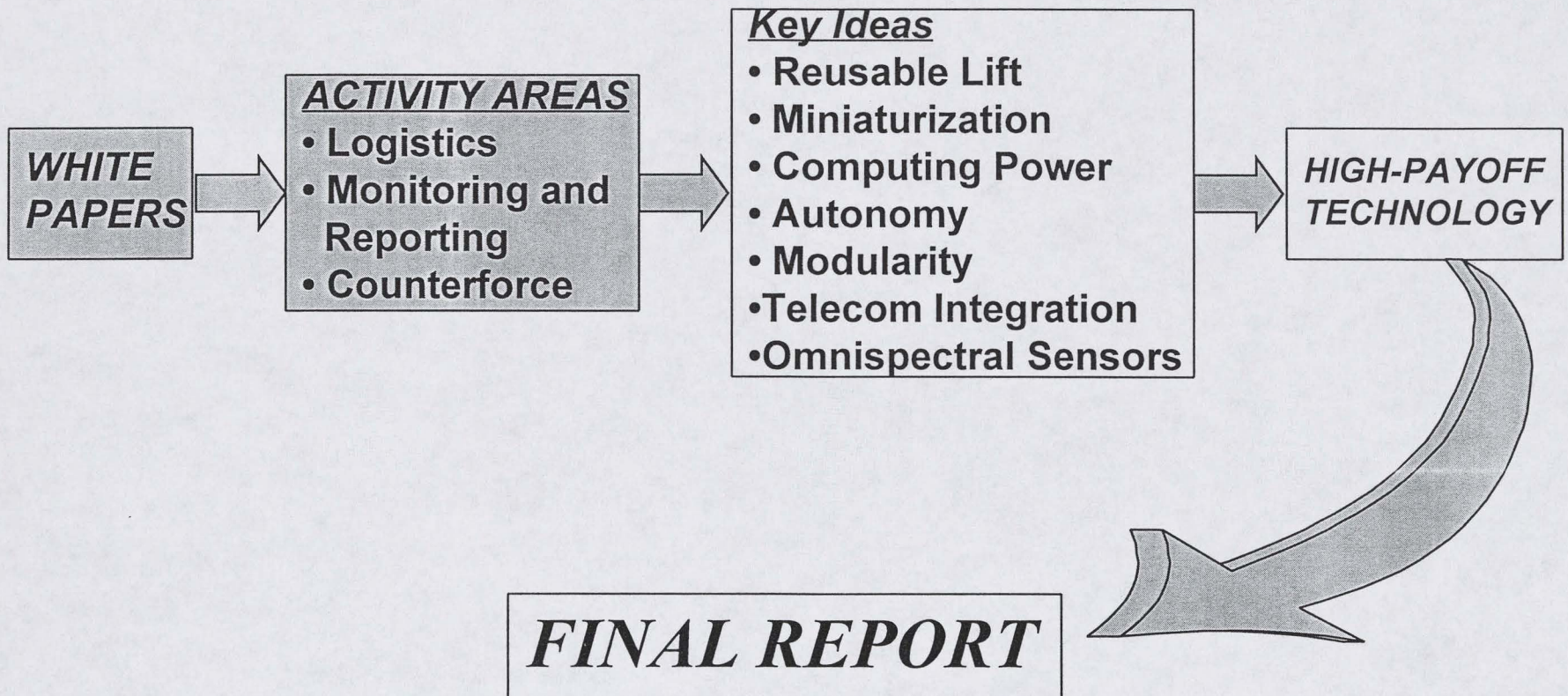
Process To Completion





SPACECAST 2020

Process To Completion





SPACECAST 2020

LOGISTICS

- **Spacelift: Suborbital, Earth to Orbit, and On Orbit**
- **Space Modular Systems**



SPACECAST 2020

MONITORING AND REPORTING

- **Integrated C3I**
- **Surveillance and Reconnaissance**
- **Weather Support for Communications**
- **GPS Follow-On Systems**
- **Space Traffic Control**
- **Weather Support Architecture**
- **Solar Monitoring and Alert System**
- **Holograms From Space**



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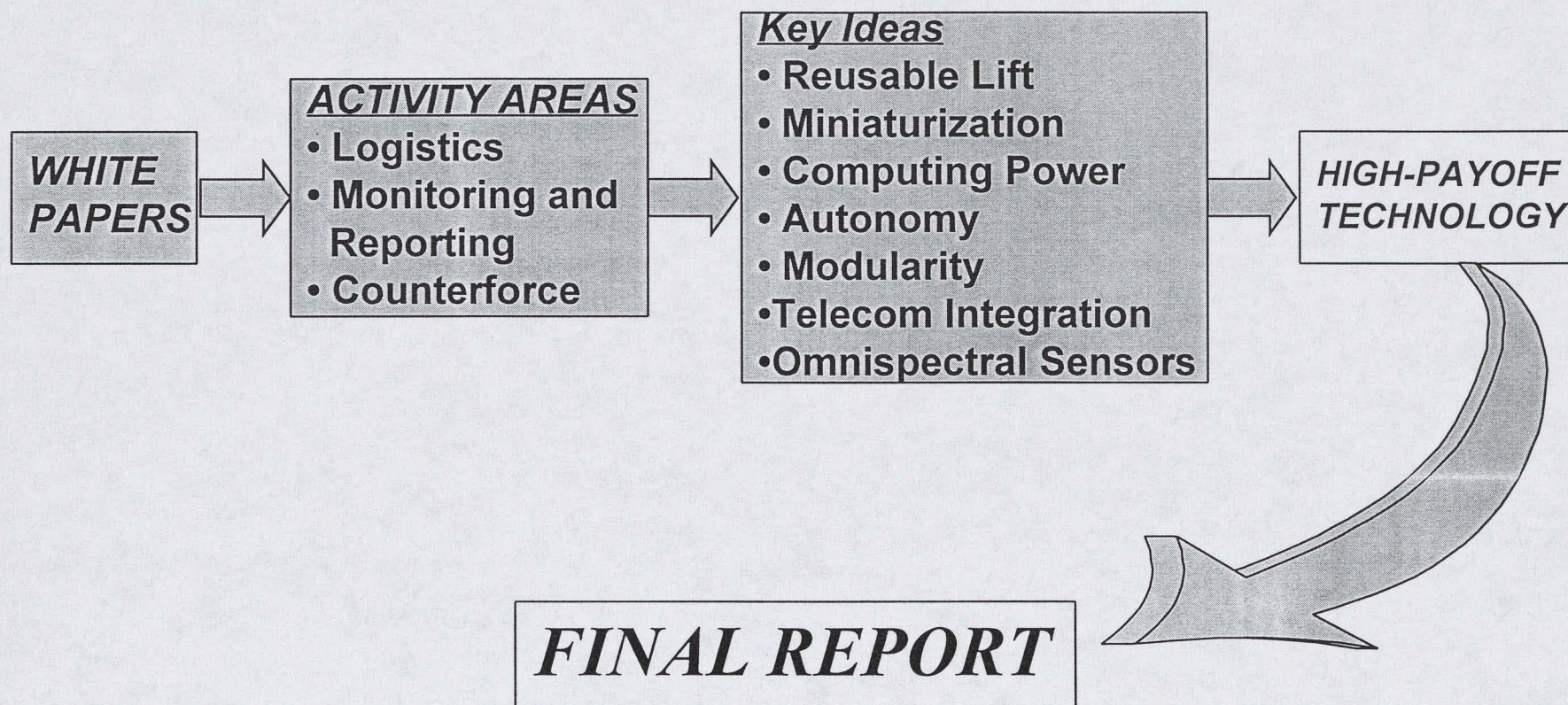
COUNTERFORCE

- **Force Application**
- **Projecting Information Power**
- **Defensive Counterspace**
- **Offensive Counterspace**
- **Planetary Defense**
- **Weather as a Weapon**



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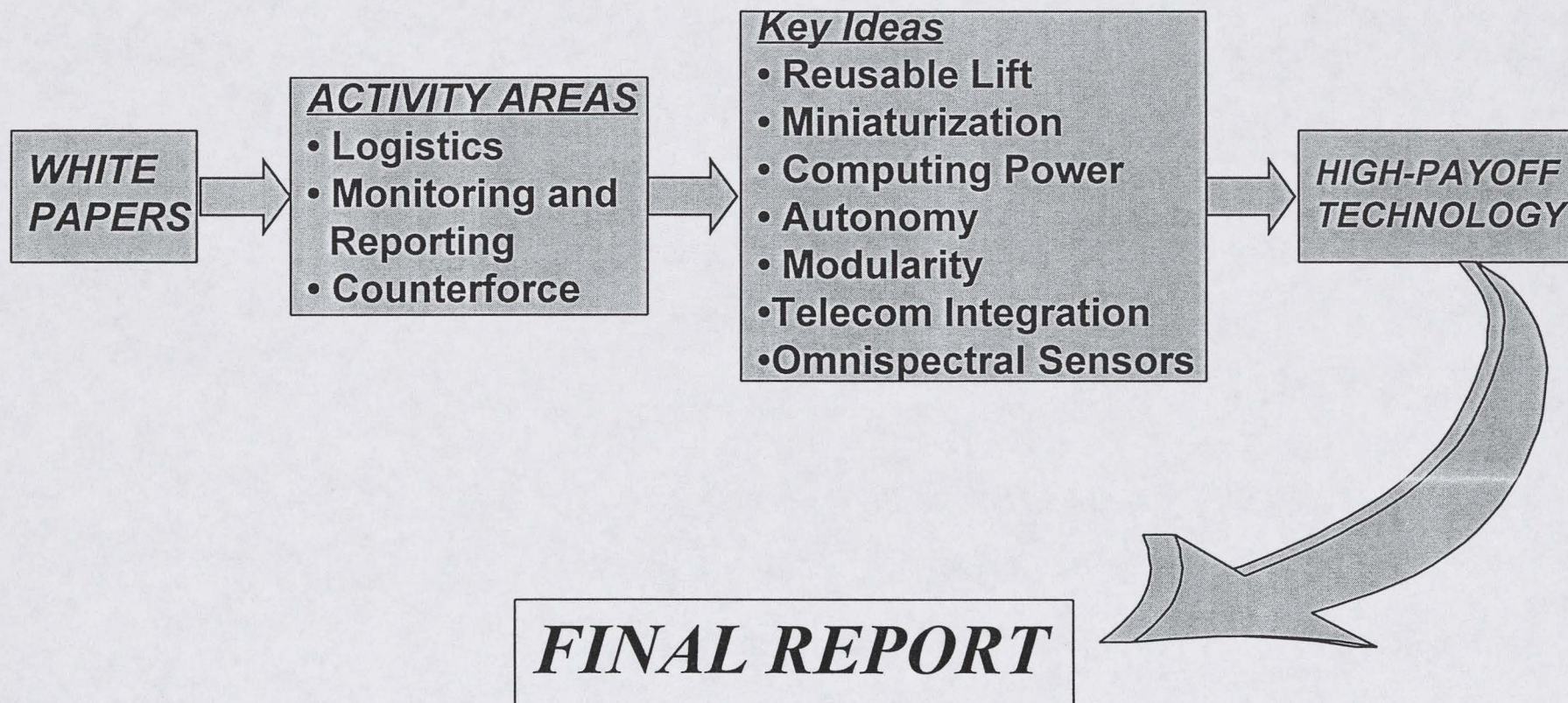
Process To Completion





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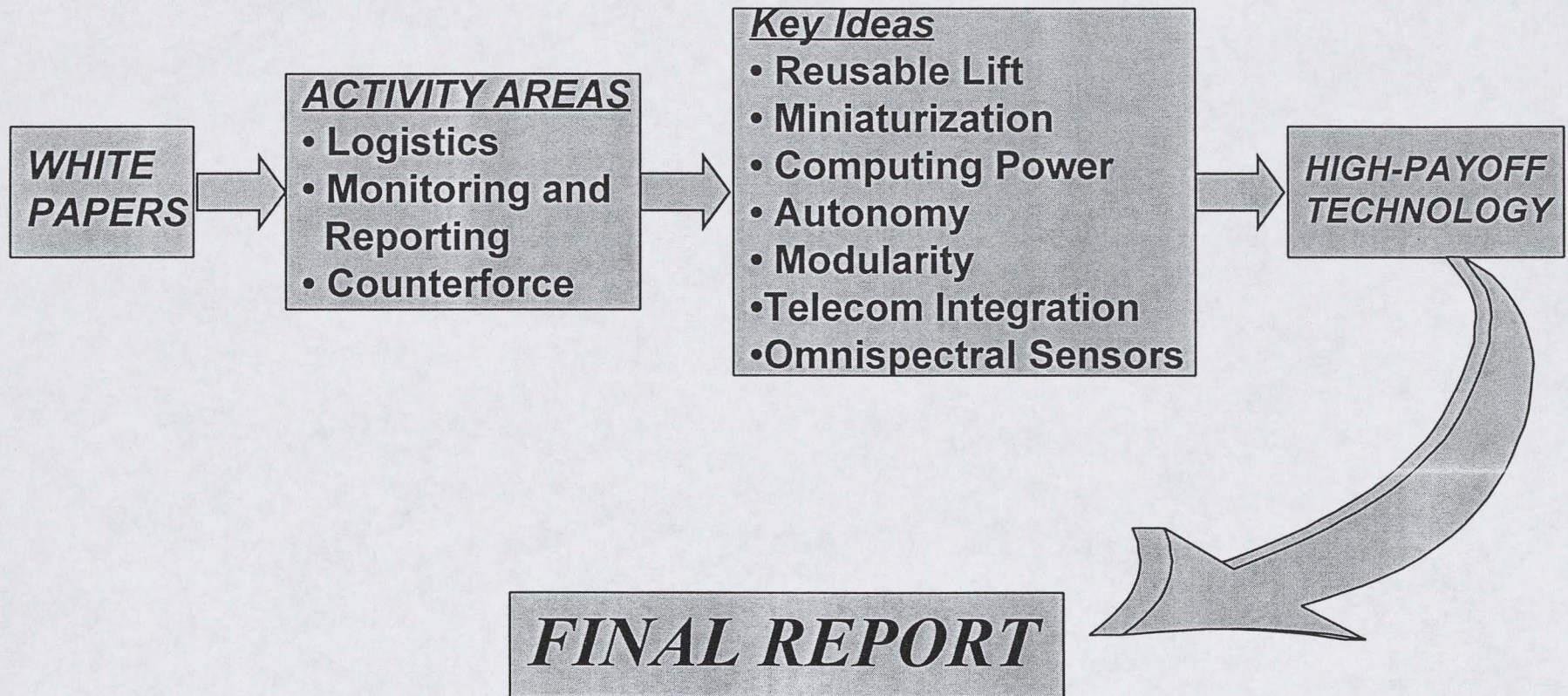
Process To Completion

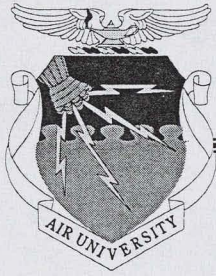




SPACECAST 2020

Process To Completion





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SPACE IMPERATIVES

- **STAYING THERE - “Air Superiority”**
- **GETTING THERE - “Access/Lift”**
- **OPERATING THERE - “Exploitation”**



SPACECAST 2020

OPERATING THERE

- Reusable Spacelift
- Integrated C3I
- Surveillance and Reconnaissance/Earth Monitoring
- Force Application
- Space Modular Systems
- Information Warfare
- Weather Support Architecture
- Weather as a Weapon



SPACECAST 2020

STAYING THERE

- **Like Air Superiority, Space Superiority is “Job One”**
- **If Our Presence is Disputed, We Must Be Able to Assert Our Rights**
 - **To Access**
 - **To Use**

ABILITY TO “STAY THERE” WILL PROVIDE FREEDOM OF ACTION



SPACECAST 2020

GETTING THERE

- **Must Achieve “Aircraft-Like” Operations and Economies of Scale**
- **Partnership With Industry Could Make It Possible**

SURVIVABLE, REUSABLE LIFT LOWERS COST AND PROVIDES FLEXIBILITY



SPACECAST 2020

GETTING THERE

- **Reusable Space and Surface-to-Surface Lift**
- **Space Modular Systems**



SPACECAST 2020

OPERATING THERE

- **National Security and Economic Purposes**
- **Value-added Complement to or Replacement for Terrestrial Forces**

MILITARY / COMMERCIAL TEAMING KEY TO POWER STATUS BEYOND 2020



SPACECAST 2020

OPERATING THERE

- Reusable Spacelift
- Integrated C3I
- Surveillance and Reconnaissance
- Force Application
- Space Modular Systems
- Information Warfare
- Weather Support Architecture
- Weather as a Weapon



SPACECAST 2020

OPERATING THERE (cont.)

- **Space Traffic Control**
- **GPS Follow-On Systems**
- **Solar Monitoring**
- **Planetary Defense**
- **Communications Weather Support**
- **Holograms From Space**



SPACECAST 2020

**STAYING
THERE**

**GETTING
THERE**

**OPERATING
THERE**

WX Support Architecture

●

Surveillance/Recce

●

●

WX Support for Comm

●

Solar Monitoring

●

Planetary Defense

●

Defensive Counterspace

●

Offensive Counterspace

●

Space Traffic Control

●

●

Space Holograms

●



SPACECAST 2020

**STAYING
THERE**

**GETTING
THERE**

**OPERATING
THERE**

Force Application

•

GPS Follow-Ons

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Reusable Spacelift

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Space Modular Systems

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Information Warfare

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Integrated C3I

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Weather as a Weapon

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SPACECAST 2020

KEY IDEAS

- **Reusable Lift**

- Lower Costs

- Operational Flexibility

- **Miniaturization**

- Reduced Lift Requirements

- Allows Proliferated Space Forces



SPACECAST 2020

KEY IDEAS (Cont)

- **Revolution in Computing Power**
 - Increasingly Powerful Machines
 - Leverage from the Private Sector
- **Autonomous Machines**
 - Reduced Link Vulnerability
 - Reduced Monitoring Requirement



SPACECAST 2020

KEY IDEAS (Cont)

- **Modularity**
 - Increase Operational Flexibility
- **Telecom Integration**
 - Real Time Integration of Sensor, Computer, Decision Power
- **Omnispectral Sensors**
 - All Sensors Capable in Visible, Radar, IR, and More

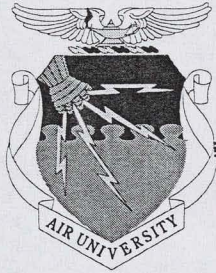
"SPIN ON" TO MARKET OPPORTUNITIES



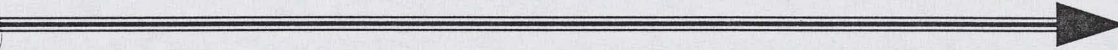
SPACECAST 2020

CHALLENGES

- **Maintain Incremental Technology Advantage**
- **Increase Time Value of Data**
- **Match Commercial Acquisition Cycles**
- **Move To Consumer-Based Standards**



SPACECAST 2020



**STAYING
THERE**

**GETTING
THERE**

**OPERATING
THERE**

Reusable Lift



Miniaturization



**Revolution in
Computing Power**



**Autonomous
Machines**



Telecom Integration



**Omnispectral
Sensors**



Modularity





SPACECAST 2020

Priority of Key Ideas

	Dual Use	Operational Utility	Vulner- ability	Cost	Time to Fruition	Score	Rank
REUSABLE LIFT <i>Orbital Surface to Surface</i>							
MINIATURIZATION							
REVOLUTION IN COMPUTING POWER							
AUTONOMOUS MACHINES							
TELECOM INTEGRATION							
OMNISPECTRAL SENSORS							
MODULARITY							



SPACECAST 2020

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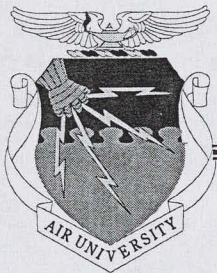
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AUTONOMOUS MACHINES	9						
TELECOM INTEGRATION	9						
OMNISPECTRAL SENSORS	8						
MODULARITY	6						



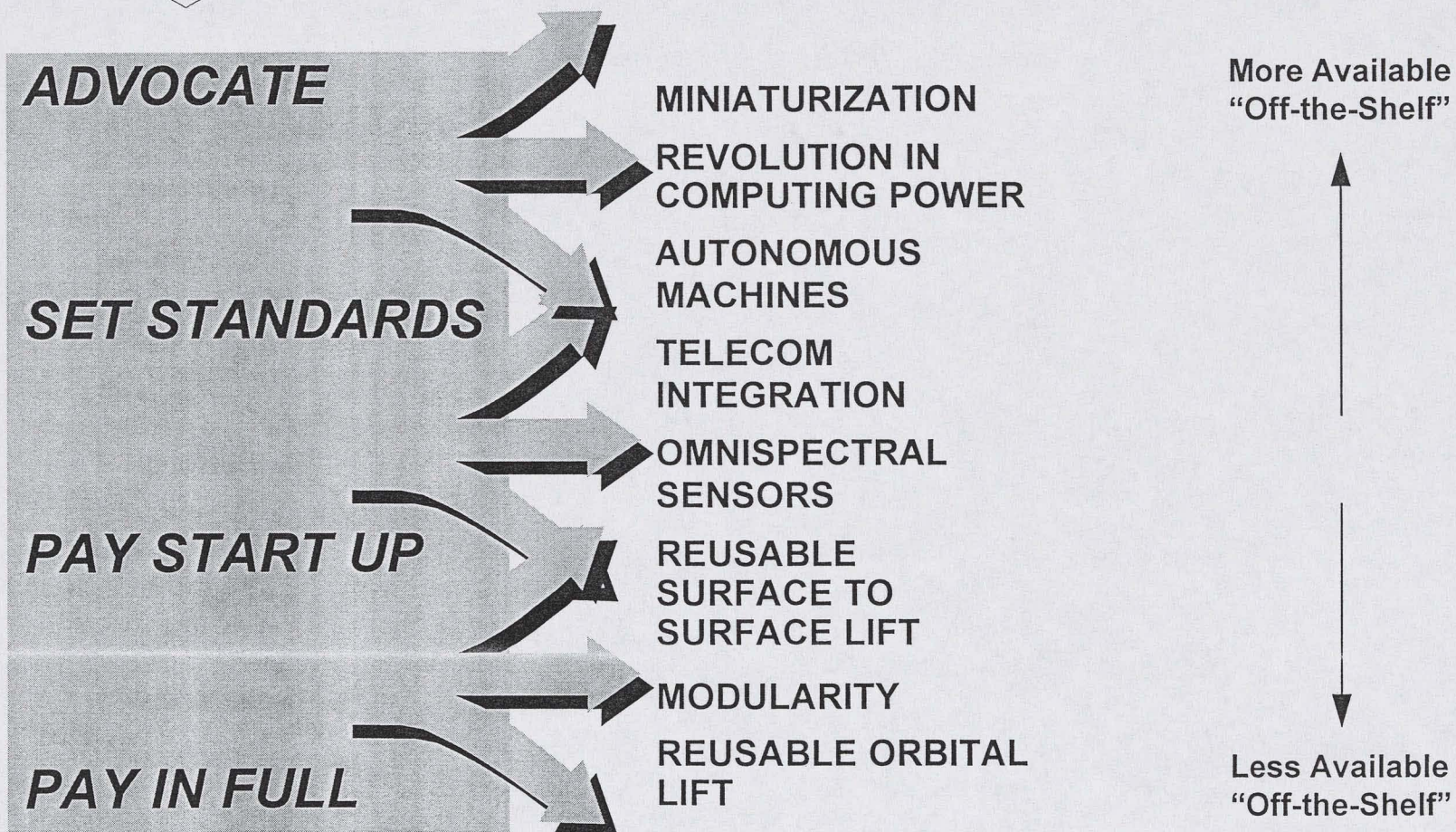
SPACECAST 2020

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MINIATURIZATION	10	10	10	10	9	49	1
REVOLUTION IN COMPUTING POWER	10	10	8	10	10	48	2
AUTONOMOUS MACHINES	9	10	8	8	8	43	3
TELECOM INTEGRATION	9	10	5	5	8	37	6
OMNISPECTRAL SENSORS	8	8	8	8	7	39	4
MODULARITY	6	6	10	7	9	38	5



SPACECAST 2020



Even for off-the-shelf systems, some "militarization" costs must be paid in full



SPACECAST 2020

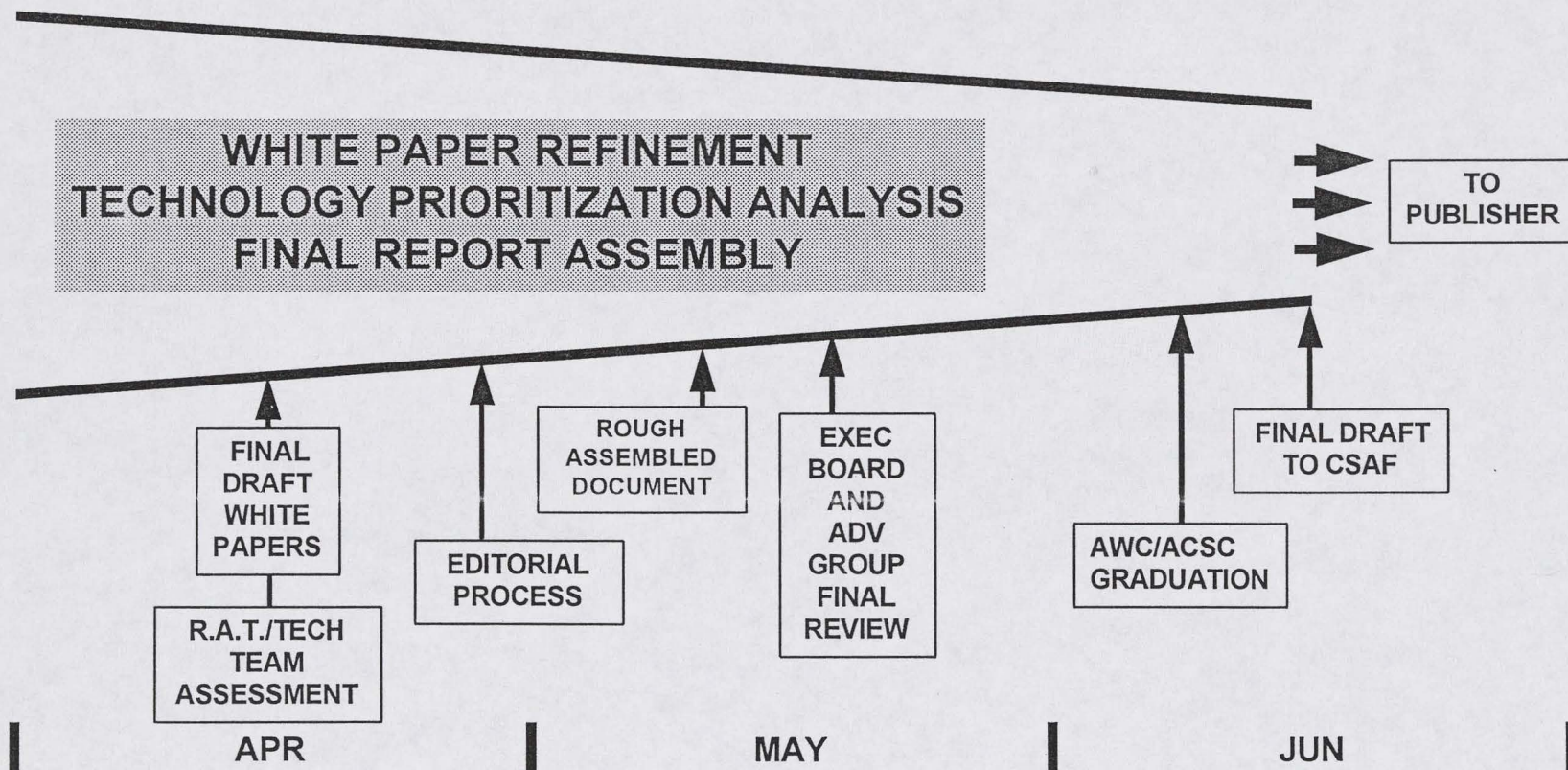
OVERVIEW

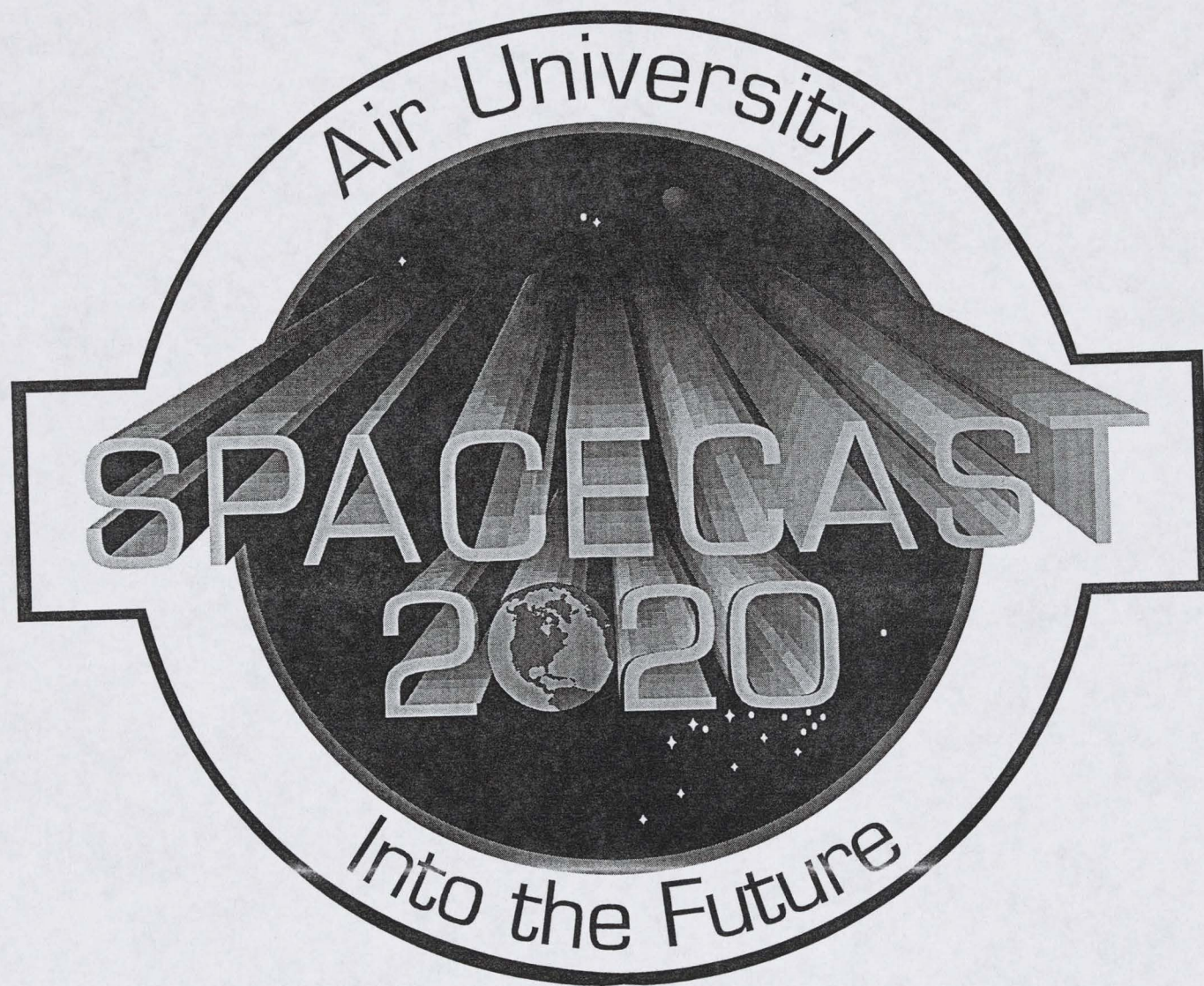
- *Recap of 24 January*
- *Accomplishments*
- *Remaining Work*



SPACECAST 2020

ROADMAP TO COMPLETION





Space Operations and Space Traffic Control

**Briefer:
Maj Chris Daehnick**

Background

- ◆ Space operations must change
- ◆ Many good reasons why we got where we are
 - Not trying to be overly critical
 - Not saying current capability isn't good
- ◆ Proposing a better approach
 - Take advantage of current and emerging technologies
 - Save money
 - Reduce vulnerability
 - Be more flexible
- ◆ Umbrella concept tying many Spacecast ideas together

Elements

- ◆ Satellite design
- ◆ Space system ground segment
- ◆ Space surveillance, tracking and ID
- ◆ Communications
- ◆ Space traffic control

Satellite Design

◆ Interfaces

- on-board
- system/constellation

◆ Miniaturization

◆ Modularity

- potential for on-orbit assembly
- rapidly tailorable designs

◆ Autonomy

- navigation
- housekeeping
- payload management

◆ Software

- operating system
- expert systems

Space System Ground Segment

- ◆ **Spacecraft control**
 - greater commonality among systems
 - expert system assistance
 - troubleshooters
- ◆ **Tasking**
- ◆ **Payload exploitation**

Space Surveillance, Tracking and ID

◆ Sensors

- space-based with ground augmentation
- mainly passive (visible only - “omnispectral”)
- space object (including debris) detection and tracking
- additional capabilities for identification

◆ Lightweight optics

◆ On-board processing

- limited *from-orbit* reporting

◆ Algorithms and interfaces

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Communications

- ◆ **High data rate, secure crosslinks**
 - lightweight and low power would be nice
- ◆ **Changing up/downlink content**
 - more information, less data
- ◆ **Multi-level security**

Space Traffic Control System (SPATRACS)

◆ Culmination of new capabilities

- satellites operate more autonomously
- space tracking is improved
- space traffic becomes more like air traffic

◆ Essential for expanded use of space

- trans-atmospheric vehicles
- greater numbers of space objects

◆ Linkable

- air traffic control system
- planetary defense system

Payoffs: Cost Savings

- ◆ **Reduce cost per unit capability of satellites**
- ◆ **Reduce frequency and duration of contacts**
- ◆ **Reduce/eliminate dependence on overseas ground sites**
- ◆ **Reduce number of operators, especially highly-skilled**
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Payoffs: Operational Improvements

◆ Responsiveness

- every phase from requirement to activation is faster
- tailored satellites possible

◆ Reduced ground segment vulnerability

◆ Increased operational flexibility

- new systems
- increased numbers of space systems
- surge/crisis operations

◆ Increased capability

- individual satellites
- basis for space control

Why Pursue This Idea?

- ◆ **If space use does not expand significantly**
 - Cost reductions are still desirable and possible
 - » Reduce specialized skills
 - » Make better use of manpower
 - » Reduce number of ground sites
 - Increase operational flexibility and responsiveness
 - Reduced vulnerability
- ◆ **Prerequisite for controlling space**
 - timely SA, track, ID, target
- ◆ **If space use does expand**
 - essential element for increased operations
 - integrated Aerospace Traffic Control
- ◆ **Key link among 2020 concepts**
 - new space ops paradigm

Steppingstones

- ◆ Technology for Autonomous Operational Survivability (TAOS) - on orbit
- ◆ MSX Space-Based Visible Experiment
- ◆ Space Surveillance, Tracking and Autonomous Repositioning
- ◆ Many other ideas and proposals

There is a need for an overarching vision/blueprint to support/drive demonstrations, and a roadmap to fit them into system development

Implications

- ◆ New spacecraft design concepts...
- ◆ Enable new space operations concepts
- ◆ Merger of SSN and SCN into SPATRACS
 - cost savings
 - flexibility
- ◆ Reinvention of ground segment
 - reduce cost
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 - distribute of functions
- ◆ Commercial opportunities?

SPACELIFT:

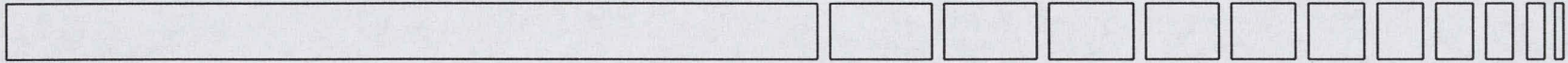
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ASSURED ACCESS

Team 1/Spacelift

Briefer:
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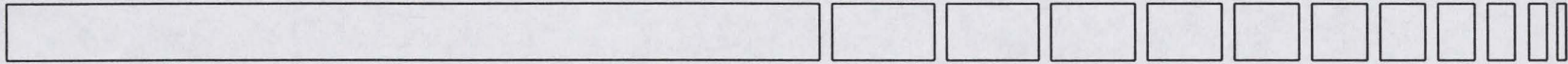
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- The Problem
- Required Capabilities
- Operations Concept
- Technical Approaches
- Dual-Use Potential

Assured Access to Space

What does it mean?



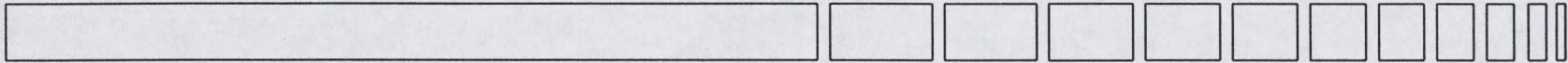
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- reliably
- quickly/responsively
- affordably

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- on-orbit operations
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- It's a prerequisite for all space exploitation
- Other white papers assume it

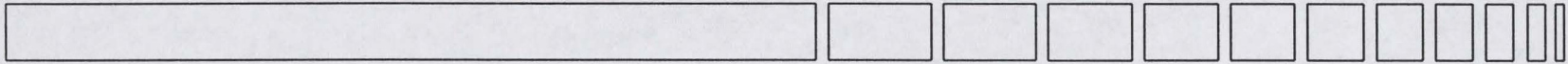
■ Many problems with current lift systems

- Cost
- Responsiveness

■ What are the keys?

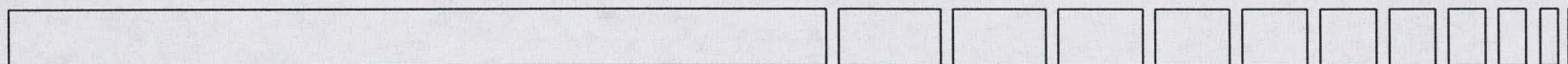
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- A reliable, low cost launch system that makes space access routine
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Desired Attributes



- Responsiveness (even quick reaction alert)
- Flexibility in missions, payloads
- Reliability
- Soft abort and resiliency
- Simplified logistics
 - minimize new/unique infrastructure
- Ease of operations
- Environmental friendliness
- Affordability
 - cost per pound to orbit, life cycle costs

Space Operations Concept



Miniaturization
Modularity/Standardization
Autonomy, new C3 concepts, etc

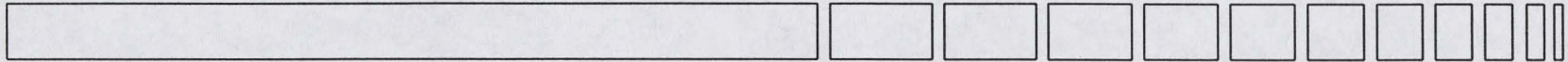
New lift concept

Operational capabilities:
Launch on demand...even alert
Responsive augmentation/
reconstitution
Tailored forces
Proliferated constellations /
graceful degradation

Reduced Costs:
Launch system
- logistics
- infrastructure
On-orbit operations
- satellites
- ground segment

Advantages

As a Weapons Delivery Vehicle



■ Reaction Time:

- < 1 Hour to Weapons on Target

■ Surprise/Unpredictability

■ Mass/Mutual Support

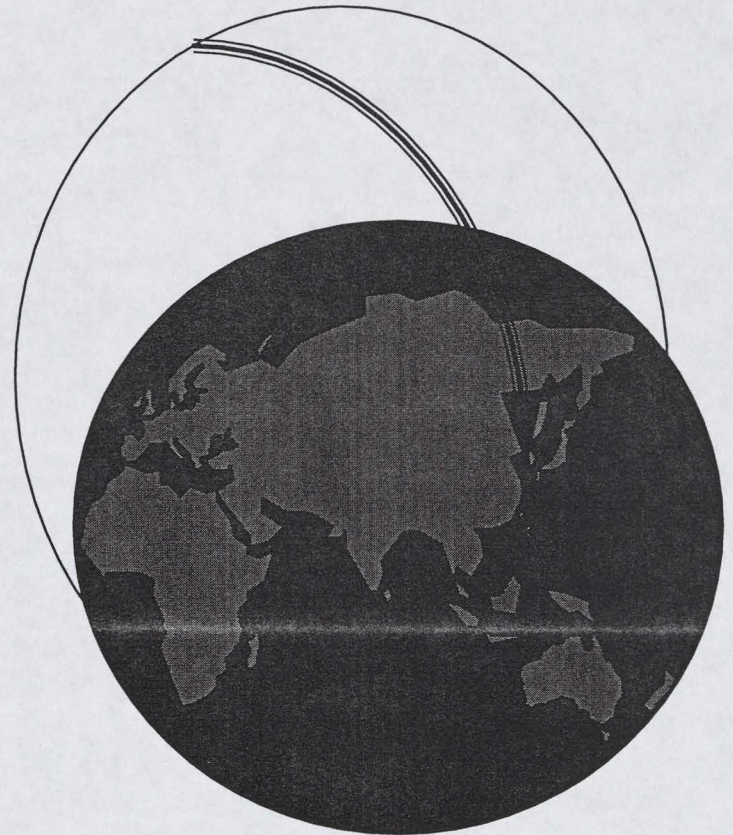
- Large Numbers of Individual Munitions

■ Standoff

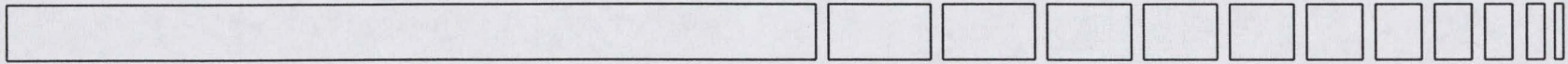
■ Flexible Countermeasures

■ Persistence

- Surge Rate of 3 Missions per Day



Weapons



■ Palletized

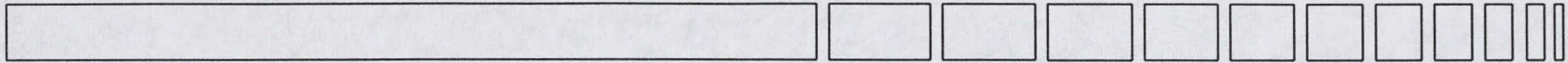
- No Weapons in Space
- Ground Storage Allows Maintenance/Upgrades
- Rapid Reloads

■ Inflight Targeting

■ All Weapons Precise

- Kinetic Energy; numerous concepts
- Chemical Explosives
- Directed Energy

How Do We Make it Happen?

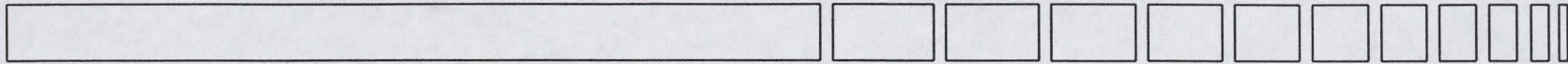


■ No silver bullet solutions

■ Assertion: a specific payload size is a poor requirements driver

- pushes performance to the limit
- reduces ability to address other issues
- miniaturization, other techniques make large payloads less necessary
- if lift is cheap enough, payloads will be redesigned

The Enabling Capability



■ **Trans-atmospheric vehicle (TAV) is operationally attractive**

– Need to overcome shuttle stigma

■ **Look for ways to make reusables feasible**

– no exotic technologies/breakthroughs

– practical development path (X-vehicle program)

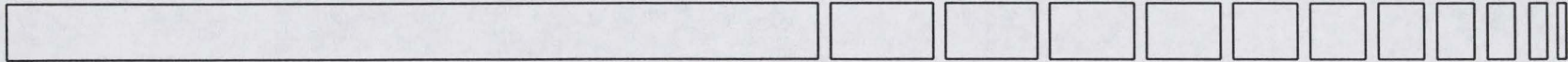
■ **Don't push for maximum performance**

■ **Design for operational effectiveness**

– reliability, responsiveness, etc

– minimum unique infrastructure

Design Issues



■ Criteria suggest non-cryogenic propellants

- JP-5 and H₂O₂ are an attractive choice
- historical evidence (Black Arrow/Black Knight/NF-104D)

■ How to reduce gross takeoff weight

- drives structure, leads to dead weight on orbit
- aerial propellant transfer a unique solution

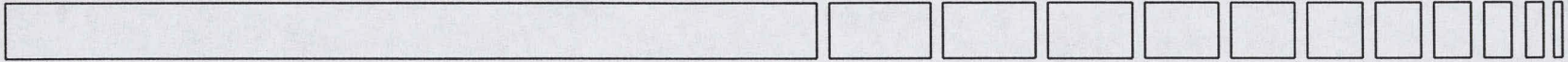
■ Take off / landing / basing method

■ Manned vs unmanned

■ Number vs Payload

■ Civil/Commercial Applications

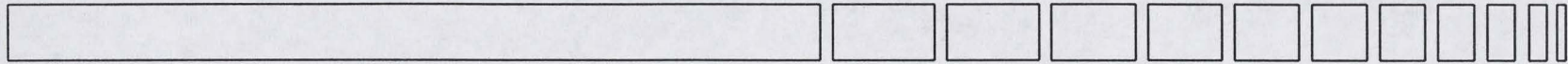
Explore Issues with X-Programs



■DC-X Derivative (X-32?)

■Black Horse

“Black Horse” X-Vehicle Program



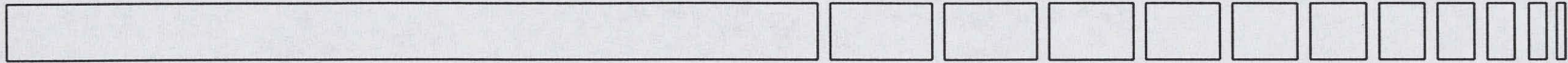
■ General Concept

- F-16 size
- Modified KC-135Q tanker
- 1000 pound payload
- 2 crewmembers
- Orbit capable
- Low-risk *components*

■ Enhancements leading to >5000 lb payload

- Composite structure
- Improved engines, fuel additives
- Vehicle and tanker size

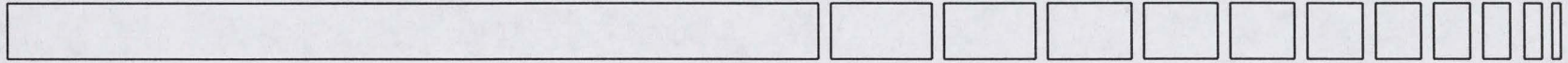
Orbital Support



■ Space-based, reusable vehicles for

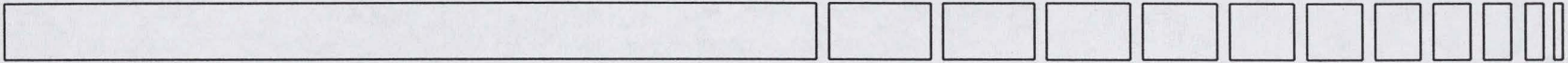
- Orbit Transfer
- Repositioning
- High Value Asset servicing
 - » Retrieval
 - » Refuel / resupply
 - » Repair / upgrade via “R&R”
- Debris collection

Why Use Such Vehicles?



- Cheaper in some scenarios
- More usable mass to orbit from launch system
- Reduces “space junk”
- Maintain “state of the art” capabilities
- Extend useful lifetime
- Optimize coverage
- Part of routine space operations

Key Technologies



■ Propulsion

- Power sources (nuclear, solar, chemical, exotic)
- Propulsion method (reactive, other)

■ Zero-g propellant transfer

■ Robotics (docking, grasping, R&R)

■ Telepresence / Virtual Reality (man in the loop)

■ Autonomy (man out of the loop)

We need X-Programs here too!

Key Points

■ Future aerospace "force structure"

■ Black Horse TAV is as operationally responsive as anyone could ask

- desirable for orbital and suborbital missions
- primary limitation is payload

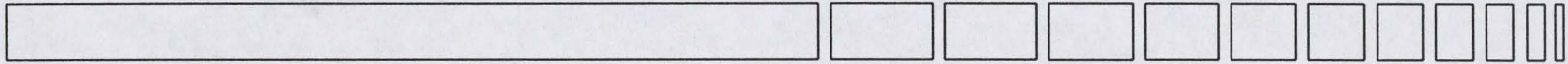
■ SR-71 ops model suggests low costs

- ~ \$250/lb to orbit recurring

■ X-vehicle program has many advantages

- apply aircraft development and test knowledge
- allows incremental upgrades
- need not be expensive

Role of the Market (and Government)



■ Commercial competitiveness in space launch/transit is essential

- a robust commercial market leads to dramatic improvements in cost and capability
- US industry must be a player for national economic interests

■ But there is a chicken and egg problem with commercialization

- a large market is needed to bring lift costs down, but
- only cheap and rapid lift makes a market possible
- the government needs to provide the first generation

Space Operations and Space Traffic Control

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 - Not trying to be overly critical
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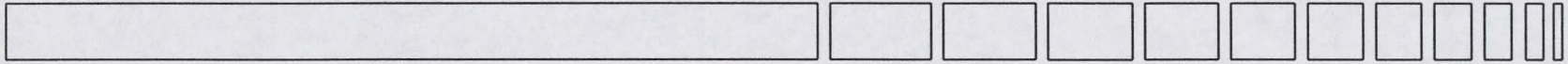
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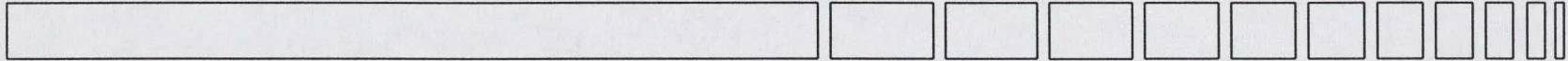
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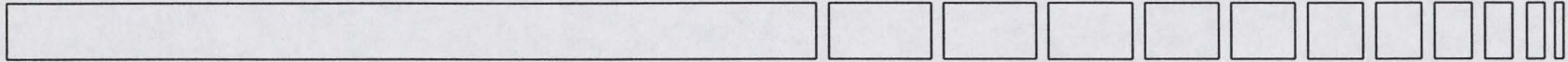
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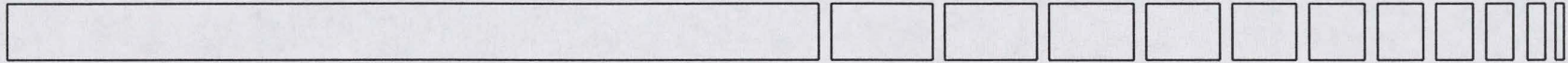
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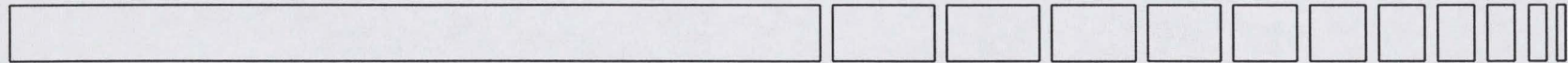
■ Ease of operations

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Autonomy, new C3 concepts, etc

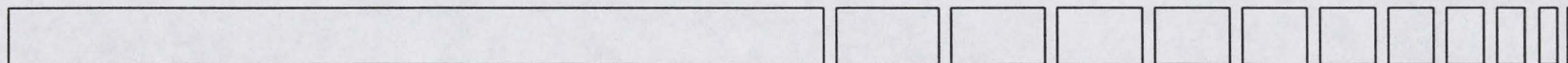
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■ Reaction Time:

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■ Surprise/Unpredictability

■ Mass/Mutual Support

- Large Numbers of Individual Munitions

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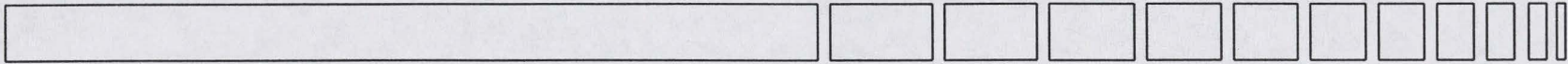
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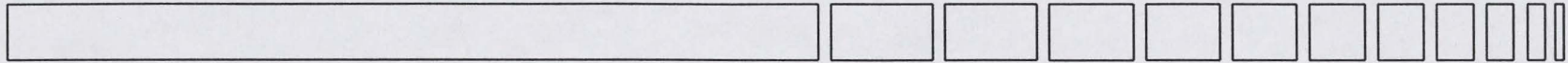
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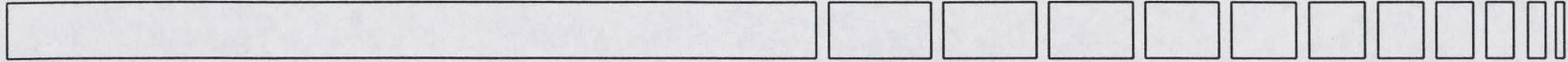


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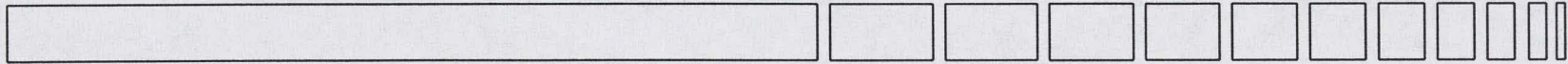
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- reduces ability to address other issues
- miniaturization, other techniques make large payloads less necessary
- if lift is cheap enough, payloads will be redesigned

The Enabling Capability



- **Trans-atmospheric vehicle (TAV) is operationally attractive**
 - Need to overcome shuttle stigma
- **Look for ways to make reusables feasible**
 - no exotic technologies/breakthroughs
 - practical development path (X-vehicle program)
- **Don't push for maximum performance**
- **Design for operational effectiveness**
 - reliability, responsiveness, etc
 - minimum unique infrastructure

Design Issues



■ Criteria suggest non-cryogenic propellants

- JP-5 and H₂O₂ are an attractive choice
- historical evidence (Black Arrow/Black Knight/NF-104D)

■ How to reduce gross takeoff weight

- drives structure, leads to dead weight on orbit
- aerial propellant transfer a unique solution

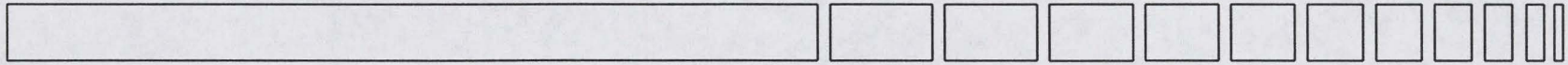
■ Take off / landing / basing method

■ Manned vs unmanned

■ Number vs Payload

■ Civil/Commercial Applications

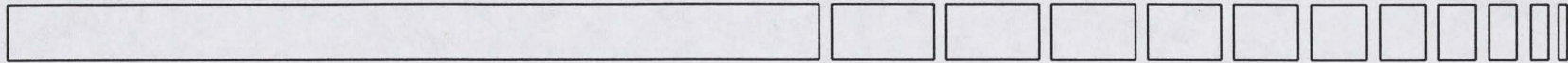
Explore Issues with X-Programs



■ DC-X Derivative (X-32?)

■ Black Horse

“Black Horse” X-Vehicle Program



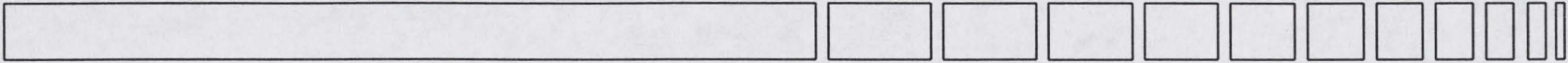
■ General Concept

- F-16 size
- Modified KC-135Q tanker
- 1000 pound payload
- 2 crewmembers
- Orbit capable
- Low-risk *components*

■ Enhancements leading to >5000 lb payload

- Composite structure
- Improved engines, fuel additives
- Vehicle and tanker size

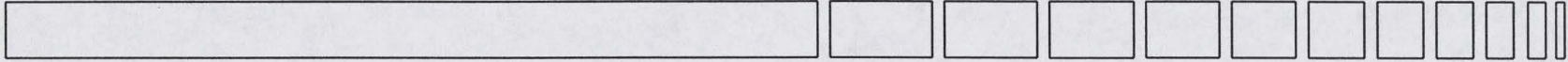
Orbital Support



■ Space-based, reusable vehicles for

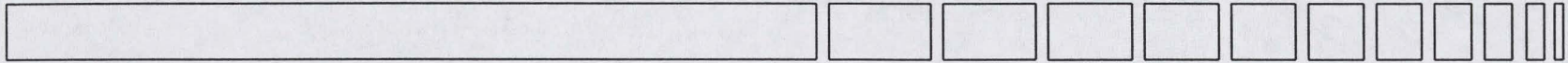
- Orbit Transfer
- Repositioning
- High Value Asset servicing
 - » Retrieval
 - » Refuel / resupply
 - » Repair / upgrade via “R&R”
- Debris collection

Why Use Such Vehicles?



- Cheaper in some scenarios
- More usable mass to orbit from launch system
- Reduces “space junk”
- Maintain “state of the art” capabilities
- Extend useful lifetime
- Optimize coverage
- Part of routine space operations

Key Technologies



■ Propulsion

- Power sources (nuclear, solar, chemical, exotic)
- Propulsion method (reactive, other)

■ Zero-g propellant transfer

■ Robotics (docking, grasping, R&R)

■ Telepresence / Virtual Reality (man in the loop)

■ Autonomy (man out of the loop)

We need X-Programs here too!

Key Points

■ Future aerospace "force structure"

■ Black Horse TAV is as operationally responsive as anyone could ask

- desirable for orbital and suborbital missions
- primary limitation is payload

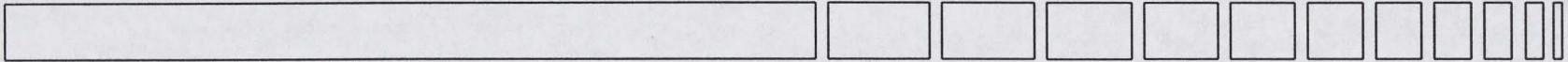
■ SR-71 ops model suggests low costs

- ~ \$250/lb to orbit recurring

■ X-vehicle program has many advantages

- apply aircraft development and test knowledge
- allows incremental upgrades
- need not be expensive

Role of the Market (and Government)



■ Commercial competitiveness in space launch/transit is essential

- a robust commercial market leads to dramatic improvements in cost and capability
- US industry must be a player for national economic interests

■ But there is a chicken and egg problem with commercialization

- a large market is needed to bring lift costs down, but
- only cheap and rapid lift makes a market possible
- the government needs to provide the first generation

TABLE OF CONTENTS

ADVISORY GROUP

Seating Chart

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Team Briefers

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CORONA Briefing

Tab C

Milestones

Tab D

Think Tank Article

Tab E

As of: 28 Mar 94

**FOR OFFICIAL USE ONLY
ITINERARY FOR VISIT OF COLONEL JOHN BOYD**

MEMBERS OF THE VISITING PARTY: The SPACECAST 2020 Advisory Group

**Colonel John Boyd
Consultant**

**Bileeting: Bldg 117 Room 5618
Room Phone: (205) 240-5600 ext 5618 or 953-2055 ext 5618**

PURPOSE OF VISIT: SPACECAST 2020 Advisory Group Meeting

SPACECAST CONTACT POINTS:

**Col Charles G. White Jr.
Duty Phone: (205) 953-7629
Maj Ava N. Webb-Sharpless
Duty Phone: (205) 953-2677**

**Home Phone: (205) 263-3123
DSN: 94-493-7629
Home Phone: (205) 271-5537
DSN: 94-493-2677**

29 March 1994

<u>TIME</u>	<u>PLACE</u>	<u>ACTIVITY</u>	<u>RESPONSIBILITY</u>
1200	West Palm Beach	Departure	
1245	Maxwell Base Ops	Arrival	Protocol
1250	Enroute to VOQ	Check-in	Protocol
1300-1350	TBD	Lunch	Escort Officer
1400-1700	AUL	Reading SPACECAST materials	Colonel Boyd
1730	TBD	Free Time	

30 March 1994

<u>TIME</u>	<u>PLACE</u>	<u>ACTIVITY</u>	<u>RESPONSIBILITY</u>
0800-0845	Officers Club	Breakfast	
0845-0850	Car	Enroute to AUL	
0850-1200	AUL	Reading SPACECAST materials	
1200-1300	TBD	Lunch	
1300-1445	AUL	Reading SPACECAST materials	
1500-1700	TBD	Interview w/SAAS student	Maj Fadok
1700-1855	TBD	Free Time	
1855-1900	Meet in front of VOQ	Walk to Officers Club	Protocol
1900-2100	Officers Club	Social/Reception (heavy hors d'oeuvres)	Maj Webb & Capt Myrick
2100-2110	Surrey	Enroute to VOQ	Protocol

<u>TIME</u>	<u>PLACE</u>	<u>ACTIVITY</u>	<u>RESPONSIBILITY</u>
2110	VOQ	Free Time	

31 March 1994

<u>TIME</u>	<u>PLACE</u>	<u>ACTIVITY</u>	<u>RESPONSIBILITY</u>
0700-0710	In Front of VOQ	Pick-up	Protocol
0715-0730	Wargaming Inst Conf Rm	Continental Breakfast	Protocol
0730-0745	Wargaming Inst Conf Rm	Welcome	Lt Gen Kelley
0745-0800	Wargaming Inst Conf Rm	SPACECAST Update	Cols White and Szafranski
0800-0820	Wargaming Inst Conf Rm	Alternate Futures	Col Engelbrecht
0820-0830	Wargaming Inst	Break	
0830-0915	Wargaming Inst Conf Rm	White Paper Survey	Lt Col Malutich Major Billman
0915-1015	Wargaming Inst Conf Rm	White Paper Teams and Q & A	Seminar Briefers
0915-1005	Wargaming Inst Conf Rm	White Paper Teams and Q & A	Seminar Briefers
1005-1015	Wargaming Inst	Break	
1030-1200	Wargaming Inst Conf Rm	White Paper Teams and Q & A	Seminar Briefers
1200-1210	Surrey	Enroute to O'Club	Protocol
1210-1250	O'Club Old South Rm	Lunch	Lt Gen Kelley
1250-1300	Surrey	Enroute to Wargaming Inst	Protocol
1300-1455	Wargaming Inst Conf Rm	White Paper Teams and Q & A	Seminar Briefers
1455-1510	Wargaming Inst	Break	
1510-1630	Wargaming Inst Conf Rm	Executive Meeting	Lt Gen Kelley
1630-1650	DV Van	Enroute to VOQ	Protocol
1650	TBD	Free Time	

1 April 1994

0900	Base Ops	Departure (C-21/ Swift 51)	
1115	Signature Flt Support	Arrival	

**SPACECAST 2020 ADVISORY GROUP
WHITE PAPER TEAM
BRIEFING SCHEDULE
31 MARCH 1994**

<u>TIME</u>	<u>BRIEFING TITLE</u>	<u>BRIEFER</u>
0830-0915	WHITE PAPER SURVEY	LT COL MALUTICH MAJ BILLMAN
0915-0935	LIFT	MAJ DAEHNICK
0935-0955	COMBAT SERVICE SUPPORT	MAJ AYALA
0955-1005	EDUCATION AND TRAINING	MAJ TRUESDALE
1005-1015	BREAK	
1015-1035	GLOBAL VIEW: C3IS ARCHITECTURE	MAJ SWEET
1035-1055	SURVEILLANCE AND RECONNAISSANCE	MAJ FURR
1055-1110	GPS FOLLOW-ON	MAJ DAEHNICK
1110-1125	SPACE TRAFFIC CONTROL	MAJ EHRHART
1125-1135	HOLOGRAMS FROM SPACE	LT COL DAVENPORT
1135-1200	WEATHER SUPPORT	LT COL HOUSE
1200-1300	LUNCH	
1300-1315	WEATHER AS A WEAPON	LT COL ADANG
1315-1335	DEFENSIVE COUNTERSPACE	MAJ GRATER
1335-1355	OFFENSIVE COUNTERSPACE	MAJ HINE
1355-1415	FORCE APPLICATION	LT COL MANTZ
1415-1435	INFORMATION WARFARE	LCDR BURKEY
1435-1455	PLANETARY DEFENSE	MAJ L. JOHNSON
1455-1510	BREAK	



CORONA SOUTH
Lt Gen Jay W. Kelley



SPACECAST 2020



PURPOSE

SPACECAST 2020:

- WILL ENVISION WHAT *CAPABILITIES* WE NEED IN SPACE
- WILL IDENTIFY INNOVATIVE *APPLICATIONS OF SPACE HARDWARE AND TECHNOLOGY* THAT SUPPORT THOSE CAPABILITIES

In the interest of national security



SPACECAST 2020

PROGRAM FLOW



PREPARE 25 Aug 93 - 17 Dec 93

DEVELOP 3 Jan 94 - 28 Feb 94

REFINE 1 Mar 94 - 31 May 94

£

Final report June 94



SPACECAST 2020

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SPACECAST 2020

PREPARATION



CREATIVE THINKING	FUTURE WORLD ENVIRONMENT/ CONFLICT	FUTURE TECHNOLOGY AND SPACE
DR ROGER VON OECH (AUTHOR)	DR CARL SAGAN (SCIENTIST)	COL TED WIERZBANOWSKI (NASP)
MR BOB KING (CONSULTANT)	DRS STEIN & LUDWIG (AWC)	COL PETE WORDEN (AFBMDO TECH CHIEF)
COL JOHN BOYD, RET (MAVERICK THINKER)	DRS A & H TOFFLER (AUTHORS)	DR EDWARD TELLER (SCHOLAR)
DR JOE HALDEMANN (SCI-FI AUTHOR)	MR CARL BUILDER (RAND)	DR LOWELL WOOD (SCIENTIST)
DR JERRY POURNELLE (SCI-FI AUTHOR)	DR JOHN ARQUILLA (CYBERWAR)	DR F.X. "DUKE" KANE (SPACE STRATEGIST)
SIR ARTHUR C. CLARKE (SCI-FI AUTHOR)	DR MARTIN VAN CREVELD (FUTURE WAR)	DR DAVID WEBB (SPACE POLICY)
MR BOB JUSTMAN (MOVIE PRODUCER)	COL JOHN WARDEN (FUTURE CONFLICT)	DR WENDELL MENDELL (SCIENTIST)



SPACECAST 2020



METHODOLOGY

- **OBSERVATIONS DESCRIBE THE WORLD OF THE 21ST CENTURY**
- **“SPACE IMPERATIVES” EMERGE FROM THE OPERATING ENVIRONMENT**
- **SPACE CAPABILITIES AND HARDWARE BEING ENVISIONED TO SUPPORT FUTURE OPERATIONS**



SPACECAST 2020

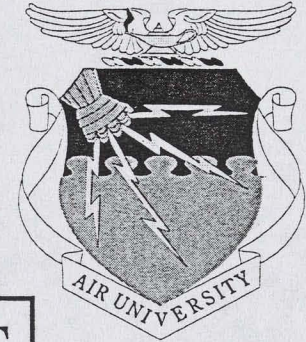


OPERATING ENVIRONMENT OF THE 21ST CENTURY

- **50% - 60% OF POPULATION IN URBAN AREAS**
- **RISE IN POWER OF NON-STATE GROUPS**
- **INCREASED IMPORTANCE OF ECONOMIC PARTNERS**
- **“CENTURY OF THE PACIFIC”**



SPACECAST 2020



OPERATING ENVIRONMENT OF THE 21ST CENTURY

- INTERNETTED GLOBAL DATA BASES
MAKE BORDERS LESS SIGNIFICANT
- EXPONENTIAL INCREASE IN COMMERCIAL
INFORMATION TECHNOLOGIES

Information technology “the key disturber”



SPACECAST 2020

SPACE FINDINGS



- ACCESS TO SPACE CRITICAL
- MUST BE ABLE TO OPERATE CONTINUOUSLY
- SURVEILLANCE INFORMATION PROVIDES LEVERAGE
- EXPECT INTEGRATION AND FUSION OF MILITARY AND NON-MILITARY SYSTEMS

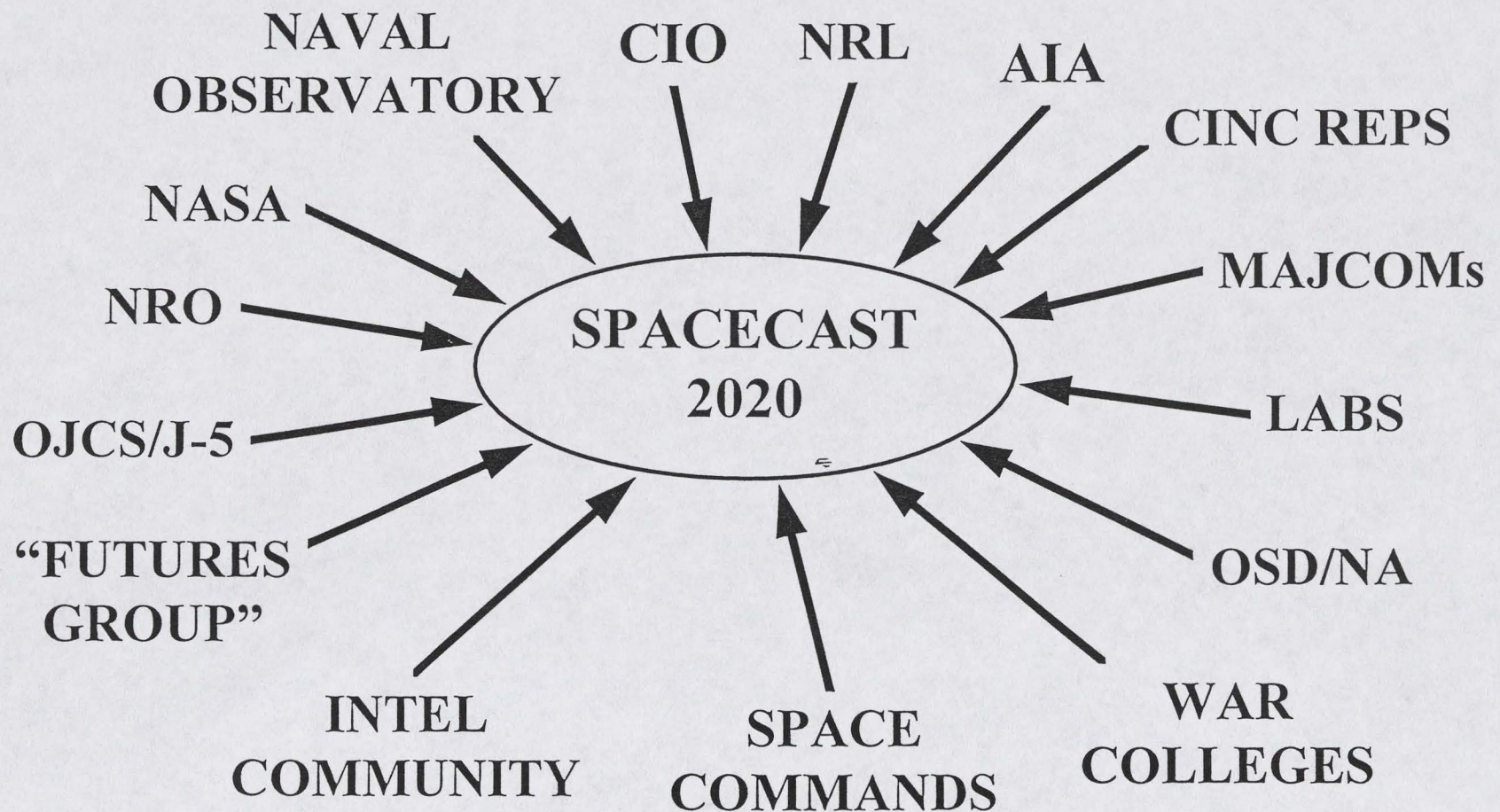
Public support is dependent on economic advantage or the threat



SPACECAST 2020



ASSESSORS





SPACECAST 2020

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Officer, Aerospace Corp

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MR NORMAN R. AUGUSTINE
Chief Executive Officer,
Martin Marietta

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Senior Associate, GIA Inc



SPACECAST 2020

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Orbital Sciences Corp

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USAF (Ret)
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USA (Ret)
Vice Pres, Land Systems for
Loral Corp

DR JOHN P. WHITE

Dir of the Ctr for Business
& Gov't, JFK School of Gov't
Harvard University

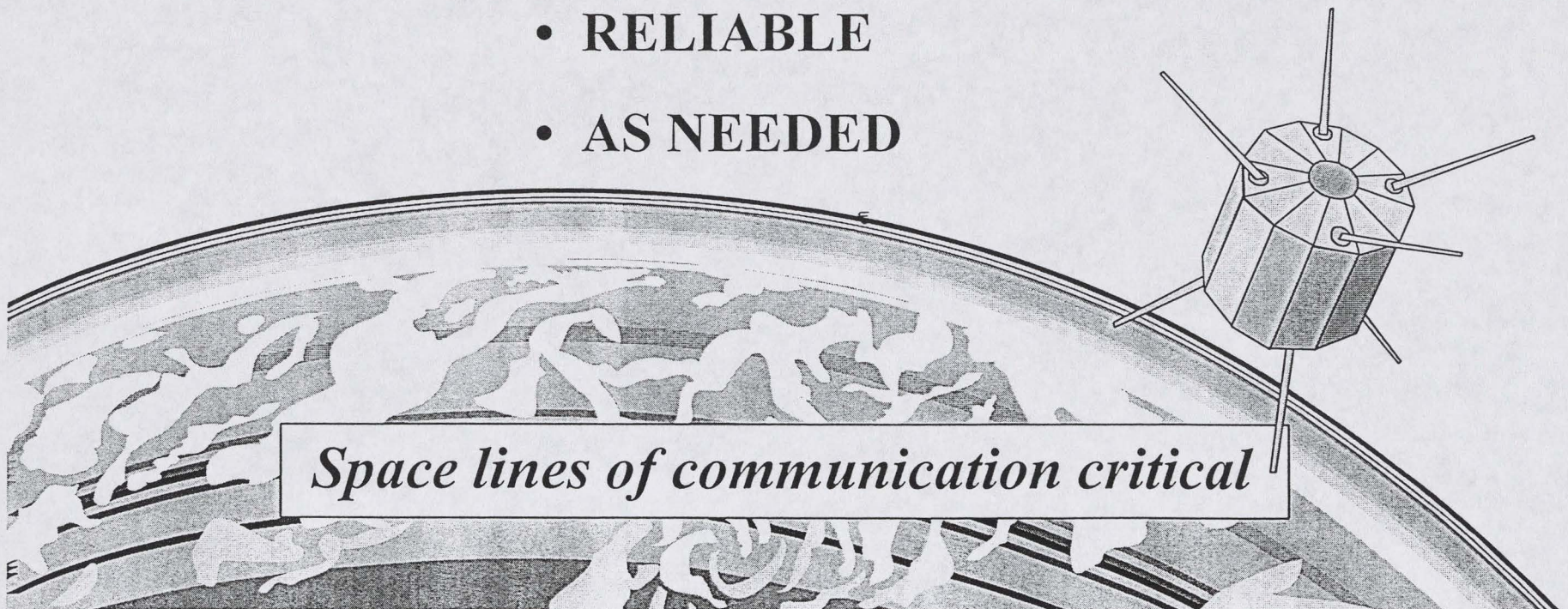


SPACECAST 2020

THE SPACE IMPERATIVES



- ACCESS TO SPACE
 - AFFORDABLE
 - RELIABLE
 - AS NEEDED



Space lines of communication critical



SPACECAST 2020

ACCESS TO SPACE



- PURSUE SСТО OR DC-X
 - MOVE TO FULL-SCALE TEST BED
 - THINK IN TERMS OF ON-ORBIT ASSEMBLY
 - NEED SMALLER SPACECRAFT AND DISTRIBUTED SYSTEMS
- ASSESSOR COMMENTS
 - “GOOD IDEA...DOABLE WELL BEFORE 2020”
 - “DEVELOP DISTRIBUTED SYSTEMS IDEA”
 - “COMBINE WITH OTHER IDEAS...BUILD A SYSTEM”
- ADVISOR COMMENTS
 - GEN SCHRIEVER: “GREAT IDEA...RE-START X-PROGRAMS”
 - MR. ALDRIDGE: “NOT A SOLUTION IN THE NEAR-TERM”
 - MR. FUQUA: “PROBLEM IS NATIONAL WILL”
 - VADM RAMSEY: “WHAT IS SON-OF-PEGASUS?”
 - DR. JOHNSON-FREESE: “NEED NATIONAL SPACE POLICY”

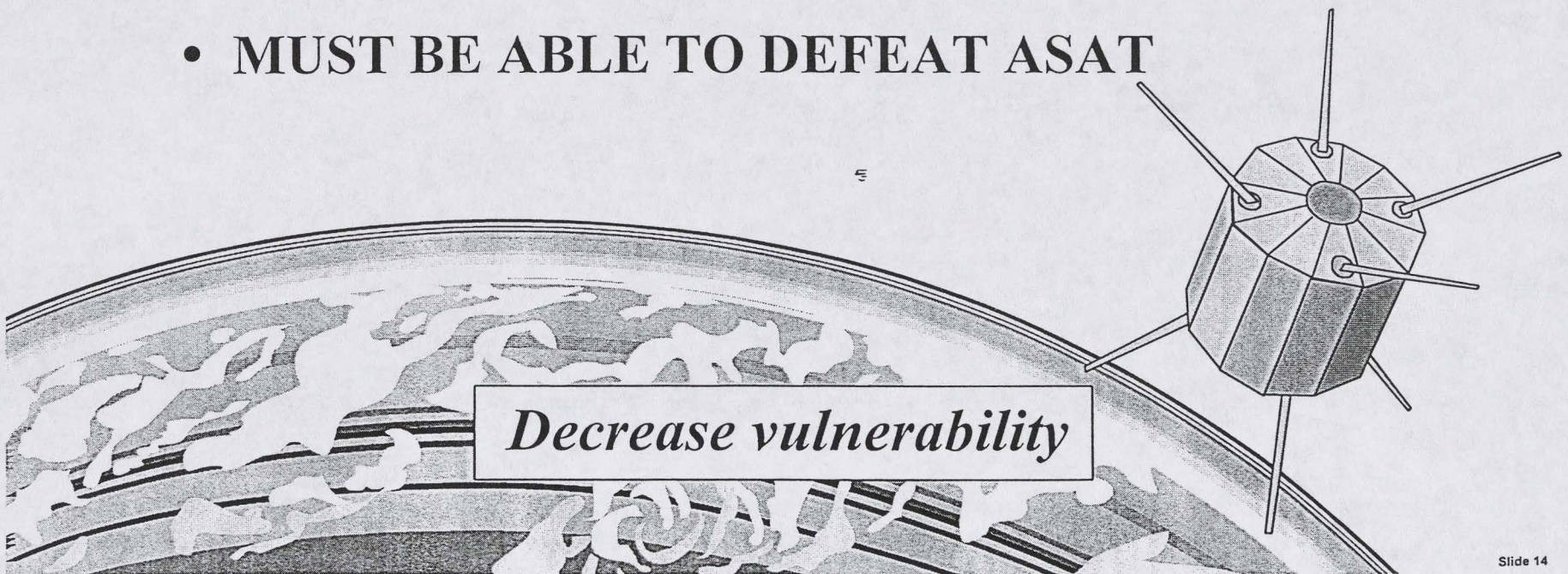


SPACECAST 2020

THE SPACE IMPERATIVES



- **ABILITY TO PROTECT SPACE ASSETS**
 - **WILL REPRESENT SOVEREIGN TERRITORY**
 - **WILL BECOME ATTRACTIVE TARGETS**
 - **MUST BE ABLE TO DEFEAT ASAT**



Decrease vulnerability



SPACECAST 2020

PROTECT SPACE ASSETS



- **DEVELOP SATELLITE SELF-PROTECTION TECHNOLOGIES**
 - SOLAR DEGRADABLE SPACE CHAFF
 - ANTI-LASER CRYSTAL DISPENSER
 - ORBITAL JAMSAT
- **ASSESSOR COMMENTS**
 - “WILL MAKE SPACECRAFT BIGGER, HEAVIER”
 - “FRATRICIDE? COLLATERAL EFFECTS?”
- **ADVISOR COMMENTS**
 - GEN WELCH: “NOT BIG FAN OF SELF-PROTECTION... PROLIFERATION, REDUNDANCY BETTER”
 - GEN SCHRIEVER: “YOU'RE ON THE RIGHT TRACK”
 - COL BOYD: “WHAT ABOUT LOW-TECH FOES?”

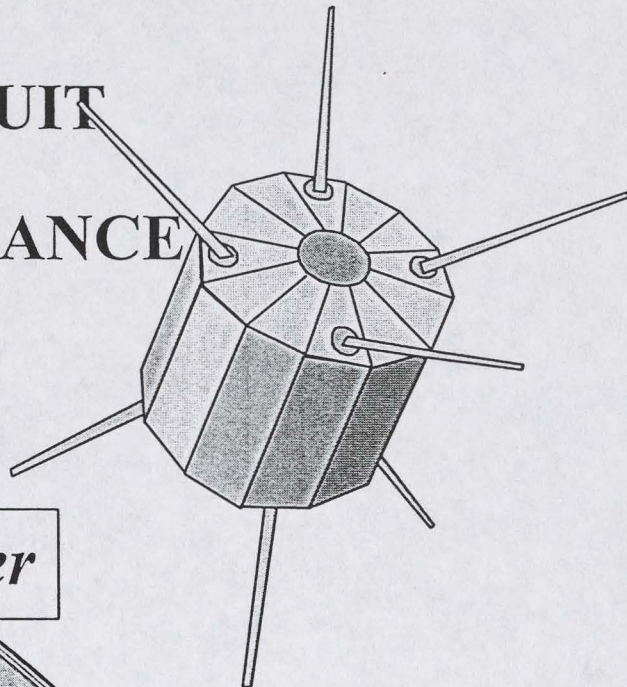


SPACECAST 2020



THE SPACE IMPERATIVES

- **CONSISTENT ACCESS TO SPACE-COLLECTED AND DERIVED INFORMATION**
 - SPACE MAY BE SOLE SOURCE
 - VITAL INFORMATION CONDUIT
 - HIGH UTILITY OF SURVEILLANCE



Information is power



SPACECAST 2020



CONSISTENT ACCESS TO INFORMATION

- **NEED CONTINUOUS GLOBAL SURVEILLANCE**
 - 3-D MULTI-SPECTRAL SATELLITES
 - TENCAP TO STEEL POT
 - UP-LINKED AND DOWN-LINKED UAV/RPV
- **ASSESSOR COMMENTS**
 - “SOME NOT 2020 AND UNDERWAY ALREADY”
 - “SPIN-ON TO COMMERCIAL EFFORTS”
 - “IMPROVEMENTS OCCURRING DAILY”
- **ADVISOR COMMENTS**
 - DR. ANDREASSEN: “LOOK AT INFO-BUS IN SPACE”
 - DR. HYDER: “CONSIDER INFO FOOT LOCKER APPROACH”
 - GEN GRAY: “SURVEILLANCE CRITICAL”
 - GEN WELCH: “COMMERCIAL SURVEILLANCE IS NOT C⁴I”

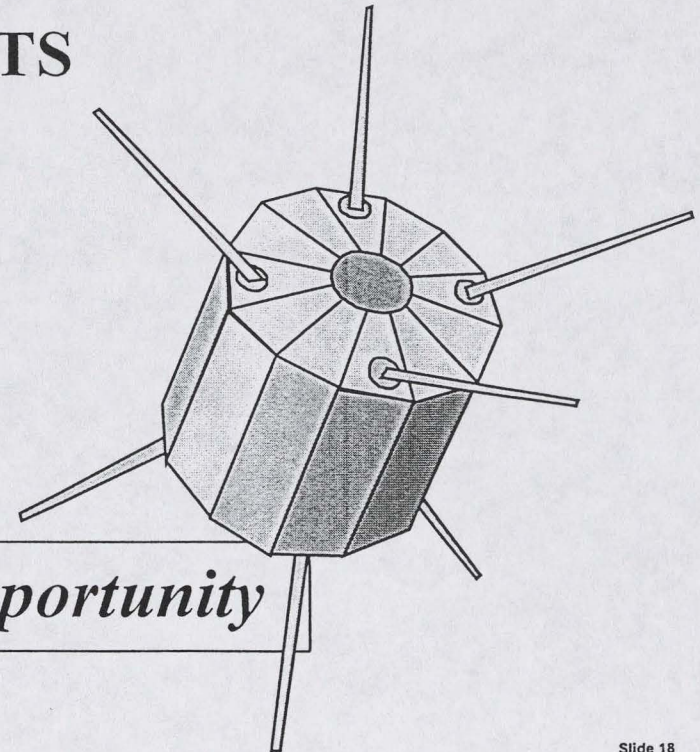


SPACECAST 2020

THE SPACE IMPERATIVES



- JOINT CIVIL, COMMERCIAL AND MILITARY CAPABILITY
 - COMMON REQUIREMENTS
 - SHARED INVESTMENT



Partnerships provide opportunity



SPACECAST 2020



JOINT CIVIL, COMMERCIAL AND MILITARY PARTNERSHIPS

- BEST OPPORTUNITIES IN COMMUNICATIONS SYSTEMS AND LIFT
 - SPACE CRAF
 - SPACE TRANSPORTATION PARTNERSHIPS
- ASSESSOR COMMENTS
 - “MANY JOINT ENDEAVORS ALREADY UNDERWAY”
 - “MANY POLICY ISSUES TO RESOLVE”
- ADVISOR COMMENTS
 - MR. THOMPSON: “NEED LEADERSHIP DIRECTION FOR LIFT”
 - MR. ALDRIDGE: “COMMERCIAL LIFT RELIABILITY UNSAT”
 - MR. AUGUSTINE: “GOVERNMENT MUST TAKE LEAD IN LIFT”
 - DR. ANDREASSEN: “COMMERCIAL COMMS WAY AHEAD”
 - GEN SCHRIEVER: “CONSIDER MILITARY-UNIQUE NEEDS”
 - GEN RISCASSI: “SPACE CRAF GREAT IDEA”



SPACECAST 2020

OBSERVATIONS

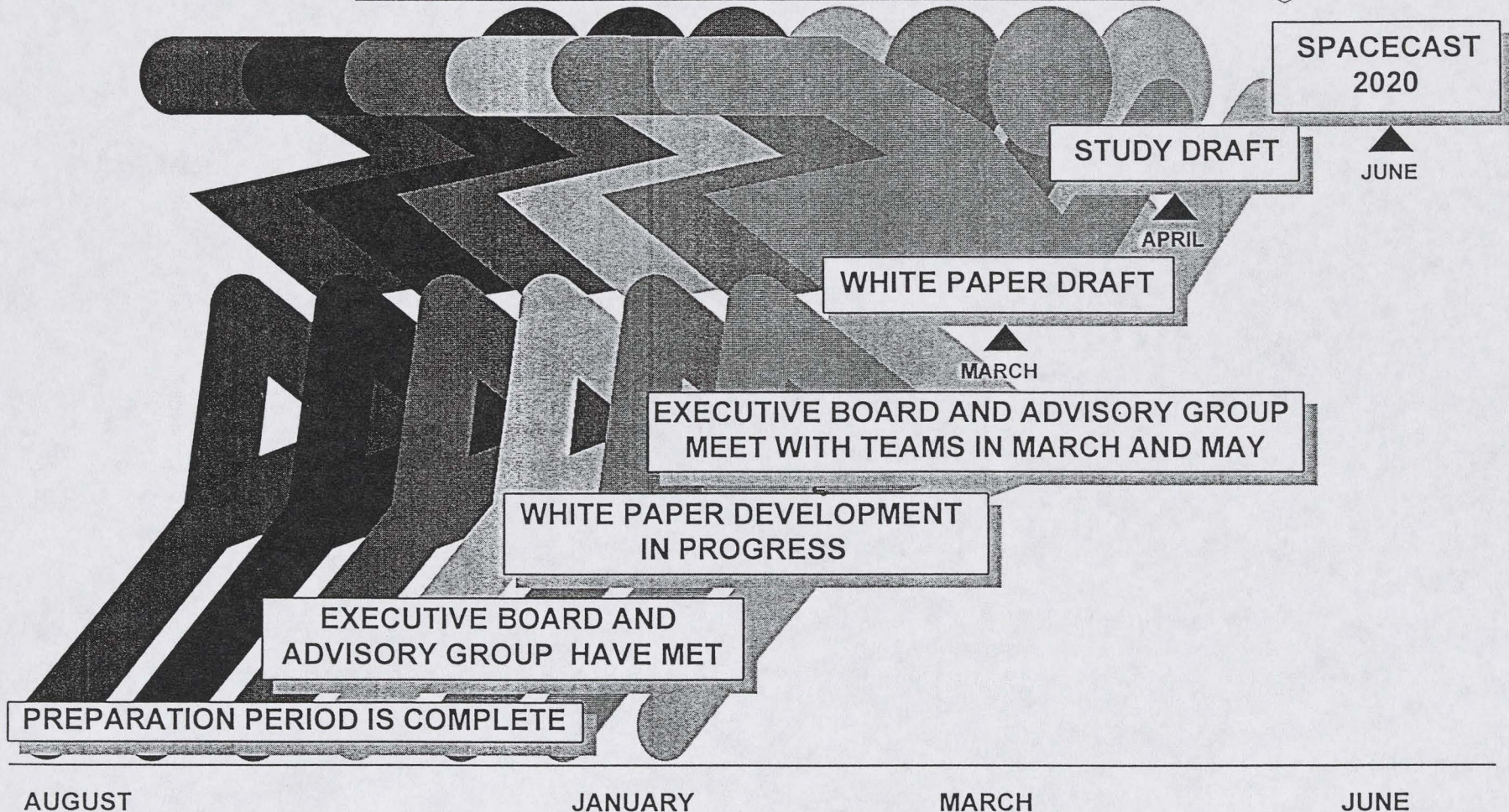
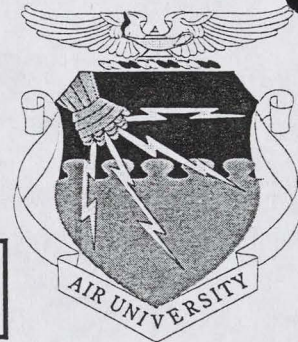


- **COMPUTER POWER, INFORMATION TECHNOLOGY,
AND “-ONICS” WILL MOVE ALONG WITHOUT DoD
— BUT LIFT WILL NOT**
- **GOVERNMENT MUST TAKE LEAD IN FIXING LIFT
— PARTNERSHIPS ARE POSSIBLE**
- **SPACE IS MORE THAN A PLACE
— DIFFERENCE ENABLES LEVERAGE**



SPACECAST 2020

PAST - PRESENT - FUTURE



SPACECAST 2020 MILESTONES

DATE

ACTION

Phase I Begins

- | | | |
|------|----------|---|
| 1993 | 25 Aug | - Brief CSAF; first seminar |
| | 10 Sep | - Msg from CSAF to MAJCOMs |
| | 15 Sep | - AFIT commences Data Call |
| | 20 Sep | - Ominbus disclosure agreement |
| | 13 Oct | - Brief players on the Data Call/white paper process |
| | | - Initial Data Call distribution to C.A.T.s |
| | 27 Oct | - AFIT Data Call process briefing/distribution to C.A.T.s |
| | 9-10 Nov | - Seminars/teams future world briefings to review panels |
| | 22 Nov | - Future world briefing to Gen Kelley |
| | 24 Nov | - Initial definition of final product format |
| | 30 Nov | - Overview and future world briefings to Executive Board; request MAJCOM requirements |
| | | - Broad, one-page, concept papers due to R.A.T. |
| | 8 Dec | - In-house symposium with seminars/teams briefing ideas to each other |
| | 17 Dec | - Holiday Break |
| | | - R.A.T. provide evaluated concept papers to Research Director |

Phase II Begins

- | | | |
|------|--------|---|
| 1994 | 5 Jan | - Reform/refocus creative activity teams. |
| | 24 Jan | - Brief Advisory Group on SPACECAST 2020 |
| | | - Initial External Agency Assessment (Expanded R.A.T) |
| | 1 Feb | - Final SPACECAST product format defined |
| | 14 Feb | - Technology Team Assessment |
| | 28 Feb | - Phase II ends with first white paper draft |

Phase III Begins

- | | | |
|--|-----------|---|
| | 1-3 Mar | - Expanded R.A.T Assessment |
| | 15 Mar | - Executive Board Meeting |
| | 14-18 Mar | - SAAS Assessment |
| | 25 Mar | - White paper draft |
| | 31 Mar | - Advisory Group meeting |
| | 15 Apr | - White paper final draft |
| | 22 Apr | - Final white paper drafts to ACSC for evaluation |
| | 13 May | - Assembled documents |
| | | - Students released |
| | 18 May | - Brief Executive Board and Advisory Group |
| | Early Jun | - Draft SPACECAST 2020 study to CSAF |
| | 30 Jun | - Final Report to CSAF |

SPACECAST 2020: A THINK TANK AT AU

General Merrill A. McPeak, Air Force Chief of Staff, is on record stating, "The effective employment of air and space power has to do not so much with airplanes and missiles and engineering as with **thinking** and **attitude** and **imagination**."

On 10 September 1993, the CSAF signed out a message to all MAJCOMs asking Air University to commission a study to identify "high-leverage space technologies and systems that will best support the warfighter into the 21st Century." The study is called SPACECAST 2020. Over 180 Air University faculty and students serve as a "think tank" to envision innovative space hardware and uses of space systems to improve our future warfighting capabilities. SPACECAST 2020 falls under the immediate responsibility of the Air University commander, Lt Gen Jay W. Kelley, who serves as project chairman, with two of our Air War College faculty members, Col C.G. ("Snip") White and Col Dick Szafranski, serving as project director and research director, respectively.

The study is being conducted in three phases. The first phase, began 25 August 1993, broadening and educating the participants with guest speakers addressing creative thinking, problem solving, future conflict, current and planned space systems, and emerging science and technologies. During this preparation phase, SPACECAST hosted 49 speakers such as creative thinkers like Dr Roger von Oech, Bob King, and John Boyd; science fiction writers Dr Jerry Pournelle, Joe Haldemann, and Dr Arthur C. Clarke; futurists Alvin Toffler, Dr Edward Teller, and Carl Builder; future conflict thinkers John Arquilla, John Warden, and Dr Martin van Creveld; and future space and technology experts Dr Lowell Wood, Dr F. X. "Duke" Kane, and Dr Carl Sagan. The AU SPACECAST 2020 team members, on 17 December 1993, completed the first phase of this CSAF study, aimed toward analyzing the US space systems and applications required for national security in the far future. Phases II and III will involve future research for analysis and synthesis using additional material gathered by AFIT's Technology Team through a world-wide data call, to develop creative concepts to benefit the warfighter of the future.

General Kelley and the SPACECAST team draw on the expertise and experience of a broad range of experts and military leaders. The study participants will be assisted by two teams of advisors--an AF/XO led Executive Board composed of AF MAJCOM/CVs and an Advisory Group composed of retired senior military officers and distinguished civilians. The Executive Board met for the first time on 30 November 1993. At that time, study participants presented them with a host of assumptions derived from the preparation period (Phase I); the presentation included a variety of characteristics about the future--from politics to economics to space capabilities--a vision of the world from 2020 to 2050.

The Advisory Group, formed to advise and assess the project as it progresses, met 24 January 1994. Members of this group are:

Mr. Edward C. Aldridge	President and CEO, Acrospace Corp.(former SECAF)
Dr. Alf L. Andreassen	Info Systems Vice President, AT&T
Mr. Bruno W. Augenstein	Sr. Scientist, Defense & Technology Planning Dept, RAND
Mr. Norman R. Augustine	CEO, Martin Marietta SECAF)
Col John R. Boyd (USAF, Ret)	Consultant
Brig Gen Elmer P. Brooks (USAF, Ret)	Deputy Assoc Admin. for Space Communications, HQ NASA
Mr. Don Fuqua	President, Acrospace Industries Assn., Inc. (Former Congressman)
Gen Alfred M. Gray (USMC. Ret)	Senior Associate, GIA Inc. (Former USMC Commandant)
Dr. Anthony K. Hyder (Moderator)	Associate Vice President of Graduate Studies & Research and Professor of Acrospace Engineering, University of Notre Dame
Dr. Joan Johnson-Freese (Coordinator)	Assoc Prof, Dept of Nat'l Security Studies Air War College
VADM William Ramsey (USN, Ret)	Vice President of Corp Business Development, CTA Inc.
Gen Robert W. RisCassi (USA, Ret)	Vice President, Land Systems for Loral Corp
Gen Bernard Schriever (USAF, Ret)	Consultant
Mr. James R. Thompson, Jr.	Exec. Vice Pres. & Gen. Mgr, Launch Systems Gp Orbital Sciences Corp
Gen Larry D. Welch (USAF, Ret)	President, Institute for Defense Analyses (former CSAF)
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Phase II of SPACECAST 2020 began in early January and involves research, analysis and synthesis of concepts of future space capabilities and technological applications. The third and final phase of the project is aimed at validating and expanding the concepts from Phase II. The final product, in the form of white papers, will be ready for submission to the CSAF by the end of June 1994. In the final product, the **SPACECAST 2020** team will produce a new vision of how space applications and systems can serve national security interests in the future--a study that will be a key tool for present and future decision makers as we move into the 21st Century.