



# **Manned-Unmanned Aircraft Teaming: *Taking Combat Airpower to the Next Level***

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# An Air Force Under-Equipped for the Threat

- Global threat environment not this dangerous since Cold War
  - Return of peer competition via Russia and China
  - Continued threat via North Korea, Iran, etc.
  - Regional instability in Middle East, Africa, etc.
  - New regional factors i.e. Arctic and a burgeoning Pacific AOR
  - Competitors are matching America's technological edge
- Airpower is in high demand
  - Deter adversaries, reassure allies, unique policy options
  - Global reach, rapid speed, decisive power projection
  - Nothing else in the DoD inventory can provide similar effects
- Air Force the smallest and oldest it has ever been since 1947
  - Combat Air Force has faced nearly three decades of cutbacks
  - Fighter and bomber inventories are down by half
  - B-2 and F-22 curtailed, F-35 ramp too slow
  - Concurrency of vital new programs limiting surge production solutions
    - *F-35, KC-46, T-X, B-21, JSTARS, PCA, O/A-X, UH-1 Recap, CRH, GBSB, Space, etc.*
- 20 B-2s, 187 F-22s, and ~100 F-35s don't meet COCOM requirements
  - Key policy options demand a bigger toolkit
  - Increasing likelihood of concurrent demand amplifies problem



# An Air Force Under-Equipped for the Threat

- “We now face, at once, a persistent war against terrorist enemies and a new era of great power competition. *The wide margin for error that America once enjoyed is gone.*”
  - Senator John McCain: *Restoring American Power: Recommendations for the FY 2018-2022 Defense Budget*
- “[Today’s security challenge] is characterized by a decline in the long-standing rules-based international order, bringing with it *a more volatile security environment than any I have experienced during my four decades of military service.*”
  - Secretary of Defense James Mattis: *Senate Armed Services Committee testimony, June 23, 2017*
- “Any objective evaluation of today’s US Air Force reaches stark conclusions. First, *the Air Force is too small for the missions demanded of it* and it is unlikely that the need for air and space power will diminish significantly in the coming decade. Second, *potential adversaries are modernizing and innovating faster than we are*, putting at risk America’s technological advantage on air and space.”
  - Secretary of the Air Force Heather Wilson and Air Force Chief of Staff David Goldfein, *2017 Air Force Posture Statement*

FIGHTERS			
1990		2018	
F-4D/E	390	F-15C/D	235
F-15A/B/C/D	890	F-15E	218
F-16A/B/C/D	1613	F-16C/D	941
		F-22A	187
		F-35A	119
Total	2893	Total	1700

  

BOMBERS			
1990		2018	
B-1B	96	B-1B	62
B-2A	1	B-2A	20
B-52G/H	230	B-52H	75
F-111A/D/E/F	286		
F-117A	48		
Total	661	Total	157



# Manned-Unmanned Airpower Vision

- Requirements drivers:
  - Meeting COCOM demand in an effective, sustainable, enduring fashion
  - Bringing numerical resiliency back into the power projection equation
  - Reducing the cost drivers for certain missions
- Based upon tangible evolutionary technological gains in:
  - Autonomy
  - Processing power
  - Collaborative information exchange
- This approach harnesses two decades of work, it is not “new”
  - This will be a crawl, walk, run approach initially focused on providing supplementary capacity in certain mission areas
  - This is about true autonomy, not long distance remotely piloted operations
- This is not a replacement for new types like F-35 and B-21—they remain essential for addressing our hardest security challenges
  - Concerted air superiority and long range strike recapitalization has been delayed too long, must reset the force or face grave operational consequences
  - Simply extending legacy types once again will fail to meet long-term mission requirements



# Manned-Unmanned Technological Principles

- **Autonomy is about dynamic decision making**
  - This is not about following a pre-planned script or long range remote control
  - Mission intent, constant assessment of circumstances, reacting to unknowns
    - Inner-loop: basic flight by sensing external conditions, comparing to desired aims, commanding necessary control inputs to achieve goal—a very mature concept
    - Outer-loop: decision making tied to achieving mission effects—this is where the manned-unmanned team is focused
- **Dynamic mission execution in a measured fashion**
  - Initial missions will focus on predictable tasks with known data: regional defense, ISR, certain air-to-ground strikes, limited air-to-air engagement
  - More complex missions involving uncertainty will involve autonomy that can self-derive a favored path, link back for human decision-making assistance, or return to failsafe mode
- **Predictable actions and trust are the bedrock of this technology**
  - This will only work if it adds mission value
  - Must trust it will do no harm and take action as expected
  - Follow established tactics and procedures
  - This is about autonomy working with people, not people with autonomy



# Two Decades' Worth of Manned-Unmanned Gains

- Why now?
  - Operational demand requirements are driving additive combat capacity ASAP
  - Inner loop of control is incredibly mature—we understand autopilot
  - Outer loop facets are increasingly robust:
    - Sensor technology is incredibly advanced and mature
    - Processing power is available
    - Communications networks are advanced and dependable
- Twenty+ years of steady developmental progress
  - MQ-1/9 RQ-4 (*1990s-today*): advance notions of control, global distributed operations, communications network, processing power, and built trust regarding unmanned potential
  - J-UCAS (*early 2000s*): unmanned assets execute complex missions, including SEAD, EA, ISR, and strike—eventually able to respond to dynamic threats and targets
  - X-47B (late 2000s-2015): building of off J-UCAS program, aerial refueling, carrier landing and takeoff, etc.
  - Have Raider I&II (2015 and 2017): collaborative manned-unmanned strike mission against a planned target, then executing strike with dynamic mission circumstances
  - AH-64—Gray Eagle Teaming (ongoing): helicopter crew control UAV sensor, receive sensor feed, and eventually employ weapons
  - Distributed Battle Management (2017-ongoing): develop common operating picture between manned and unmanned mission systems, execute dynamic mission in a comm degraded environment



# Changing the Game

- Relieve high demand, low density aircraft of lower-tier missions
  - Focus highly capable aircraft and well trained crews on hardest missions
  - Advance into more taxing scenarios as technology matures
- Unmanned aircraft only need to fly to meet basic maintenance requirements and mission execution
  - Vastly lower flying hours affords “banked mission effect” at far lower annual cost
  - Could park in storage during periods of low perceived risk and reactivated when necessary
  - Afford surge potential without standard human cost drivers and schedules
- Decouples the notion of mission proficiency from peacetime flying hours
  - Unmanned autonomous learning is universal—simply upload “new knowledge” fleet-wide
  - Unmanned autonomous systems do not forget, do not require proficiency training
  - Manned-unmanned training largely executed via LVC
- Not tied to any particular mission
  - Technology could be harnessed for air superiority, strike, ISR, EW, etc.
  - Can be stationed abroad to signal to adversaries, without associated personnel and logistical requirements of a manned unit
- Extend mission parameters past standard human-driven limiting factors
  - Mission duration, G’s associated with maneuvering, high threat risk



# Realize Operational Gains, Limiting Cost & Risk

- Harness stored fighters and bombers
  - Certified combat airframes with apertures, weapons carriage capability, comms
  - Familiar, predictable performance
  - No acquisition cost, with limited upgrades required
  - Limiting flying hours, so high time airframes not a problem
  - No humans at risk
  - MILCON and allied interoperability assured
  - Existing maintenance and operations support system exists
- Focus on the hard problems, use mature technology for everything else
  - It is what allowed efforts like F-117 to succeed
- Quick, low risk development will yield real-world lessons
  - This is as much about developing CONOPs as it is about technological gains
- Once necessary autonomy is mature and mission is better understood, consider expanding potential with purpose-built airframes
- Conversion of legacy types should never be abandoned given need for combat surge and attrition backfill

# Path Forward

- The world is increasingly dangerous, leaders need a broad range of viable options
  - The past thirty years are not a reflection of what the future holds—we must build an competent force from both a capacity and capability perspective
  - Focus must remain on building decisive combat power
- The technology is increasingly ready
  - Over twenty years of successful development
  - Apply it to any aircraft or mission
- Budget realities demand low cost, low risk solutions
  - Key modernization efforts must continue—B-21, F-35, KC-46, etc.
  - Get this in the hands of the operators ASAP to advance the concept
- There is little downside to pushing forward with initial trials
  - The cost of inaction is far greater

