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

Douglas Birkey  
Executive Director, Mitchell Institute for Aerospace Studies

Lt Gen David Deptula, USAF (Ret.)  
Dean, Mitchell Institute for Aerospace Studies

Maj Gen Lawrence Stutzriem, USAF (Ret.)  
Director of Research, Mitchell Institute for Aerospace Studies
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, GBSD, 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.”

- “[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
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