



NAVAL
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Determination of the Utility of Submarine Launched Unmanned Aerial Systems (UAS)

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Excellence Through Knowledge



Motivation for Research

- Advanced Weapons Enhanced by Submarine Unmanned Aerial System against Mobile Target (AWESUM) JCTD, dtd 10APR2012
- USFF, PACFLT, COMSUBPAC, COMSUBFOR Requirements for Submarine Launched-And-Operated Unmanned Aerial Systems letter, Ser N03/017, dtd 28 SEP 11
- PACOM & SOCOM Fiscal Year (FY) 14-17 Integrated Priority Lists (IPLs)
- CSF Requirements for Submarine Launched and Operated UAS, letter, Ser N00/00019, dtd 16 Jan 07

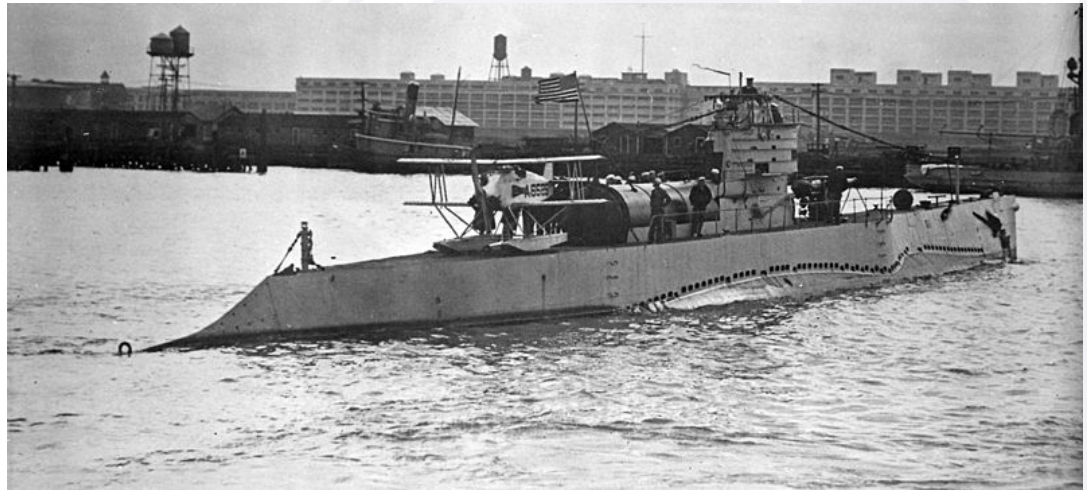
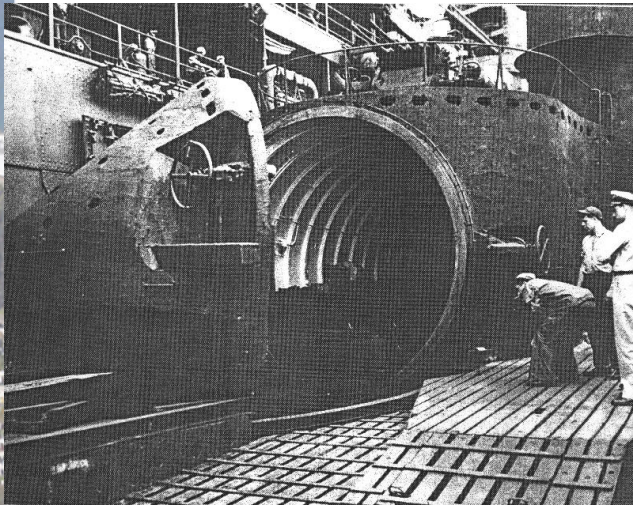
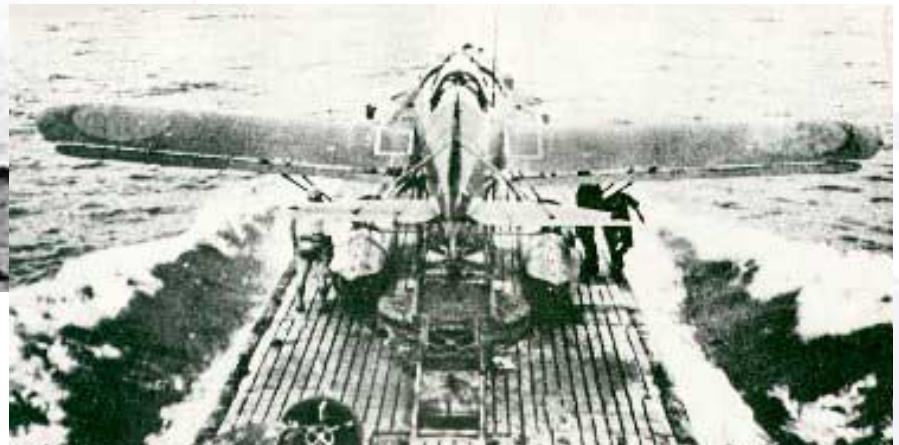




- Submarines need the capability to launch and operate Unmanned Aerial Systems in order to conduct a variety of missions in support of COCOM, CJCS, and national tasking, including but not limited to:
 - I&W
 - ISR
 - mission planning and targeting for SOF
 - OTH-Targeting for ASuW



Submarine Launched History





Submarine Launched Aerial Assets

- September 9, 1942
 - Japanese drop incendiary bombs in forest near Brookings, OR from submarine launched plane
- Post WWII
 - Multiple nations develop / test submarine launched aerial assets
- 1996
 - USS Chicago controls a Predator UAV from periscope depth
- 2005
 - USS Albany launched first UAV from surfaced submarine



Historical attributes

Pros

- Aerial Assets were recoverable
- Ability to refuel / rearm / reuse
- Divorced operations of aerial / submarine asset
- Weaponized

Cons

- Organic Launch / Recovery required surfacing
- Sea-state could inhibit launch
- Manned aircraft
- Limited communications





Historical Lessons Learned

- Surface launch / recovery removes submarine tactical advantage of stealth for short period
- ISR capabilities limited by range of aerial assets and ability to close target prior to launch
- Limited weapon payload capability made strike tactically irrelevant
- Launch of aircraft put submarine at risk





Current Attributes

Pros

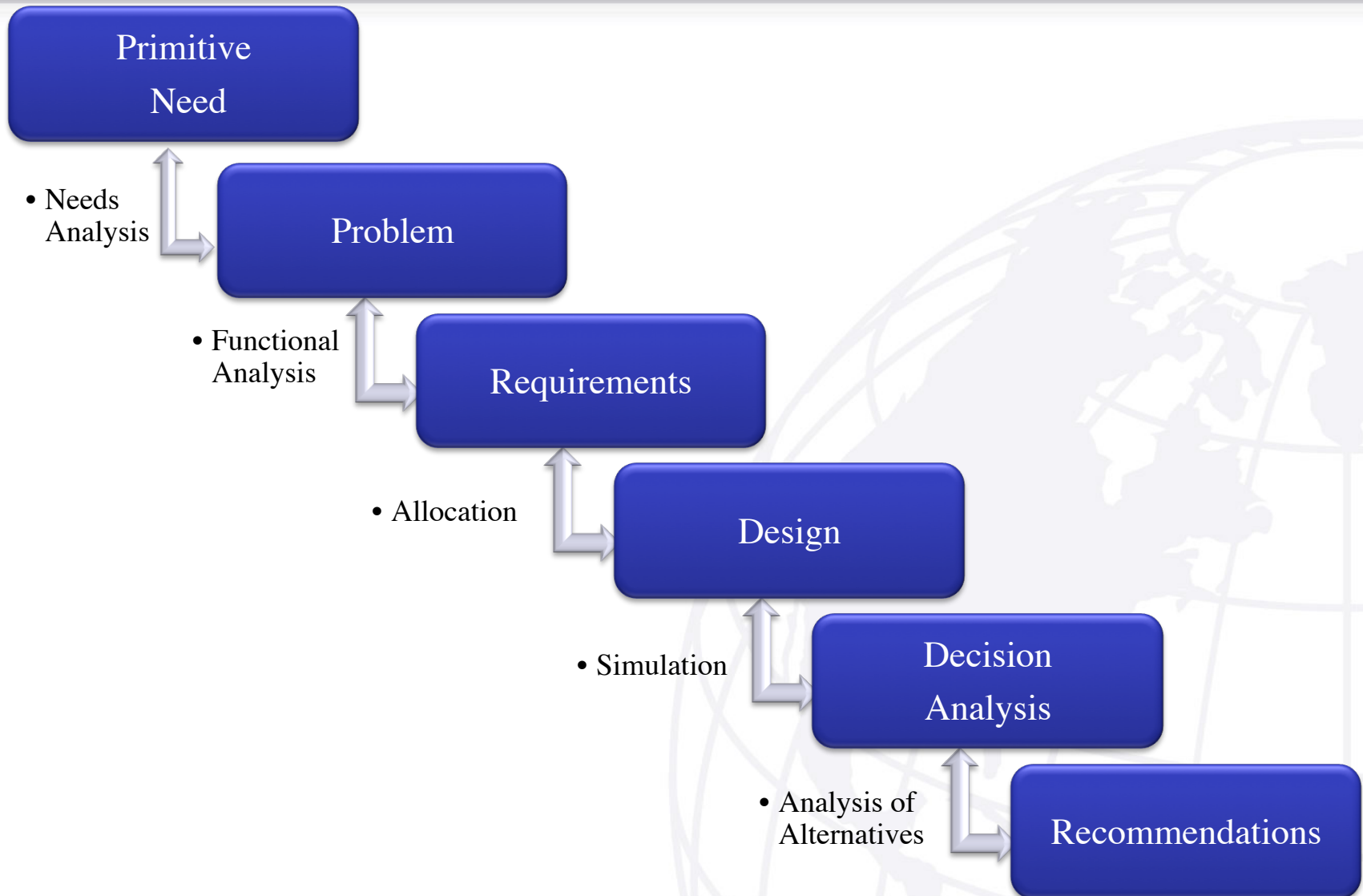
- Submerged launch
- Unmanned assets
- Advanced sensor payloads

Cons

- Not organically recoverable
- Requires constant LOS communications
- Limited on-station time
- Not serviceable
- Not lethal



System Engineering Process





Stakeholders



- Simulation
 - Explore impacts of UAS on weapon employment
 - Method yet to be defined
- Surveys
 - Determine preferences from stakeholders
- Trainer Exercise
 - Utilize fleet assets to compare simulation results





- UAS parameters
 - On-station time (min)
 - Launch time (min)
 - Personnel required for launch
- Weapons Employment
 - % Range error in target solution
 - Number of weapons launched in DRM
 - % hits on HVU
 - % hits on any vessel





Goals

- Determine if submarine launched-and-operated UASs are the proper tool for capability enhancement
- Identify universal UAS payload to cover identified areas of capability enhancement
- Determine acceptable impacts on weapons load out

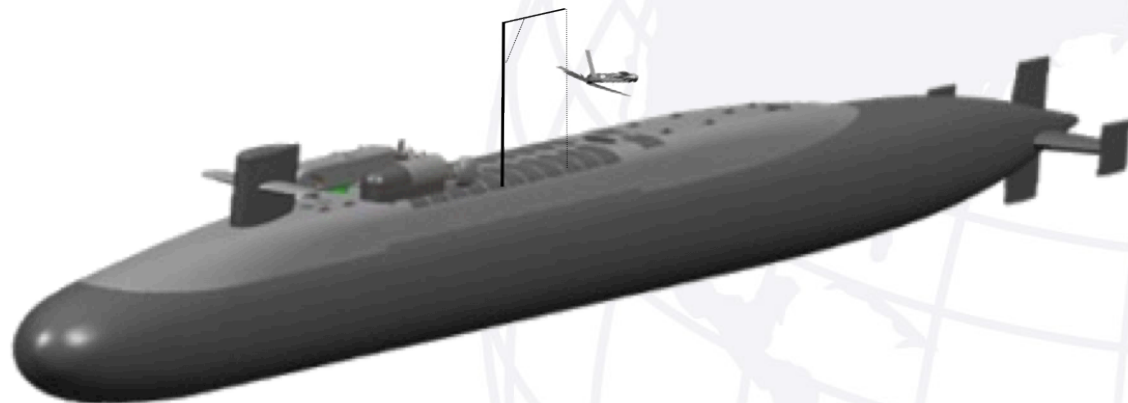
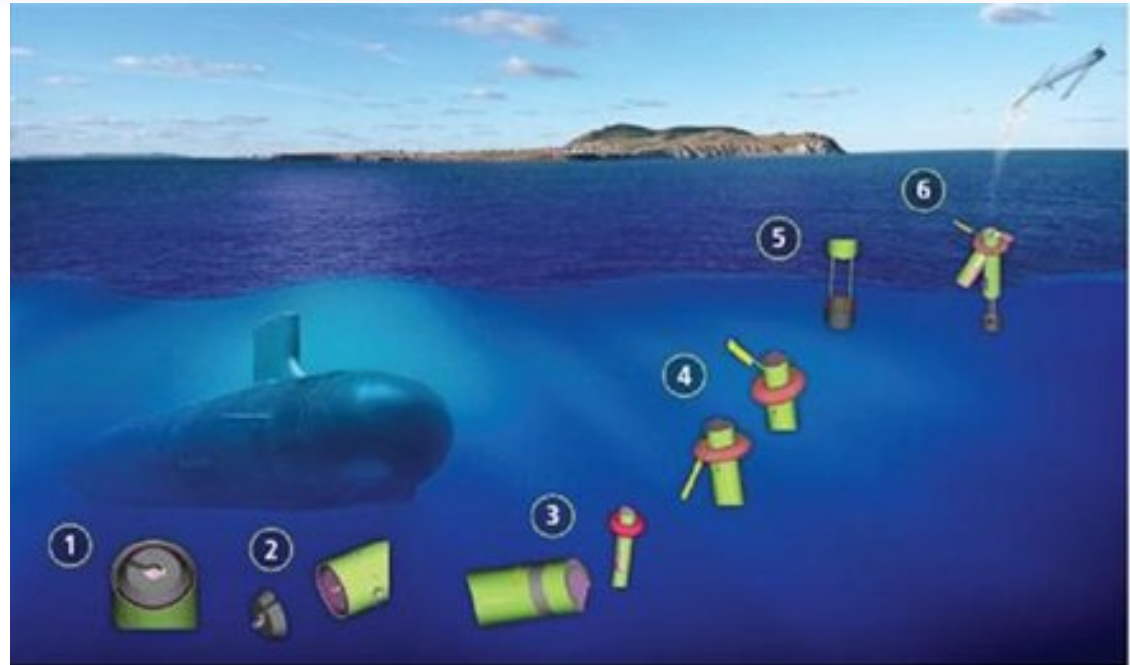
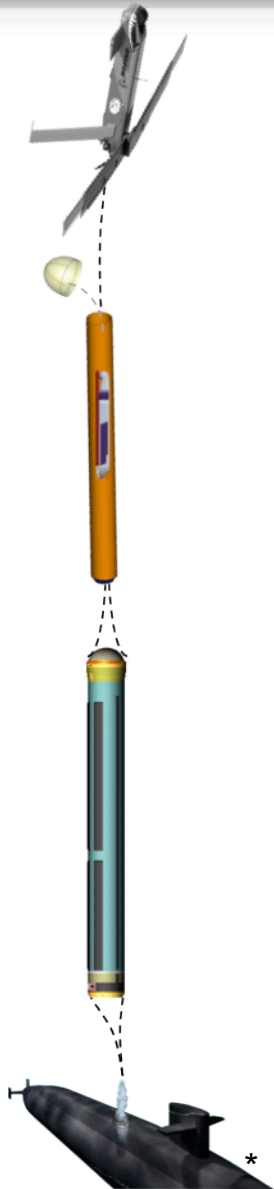




- Submit IRB proposal to allow for survey data collection
- Continue application of system engineering process
- Design and implement simulation experiment



Future?





Questions





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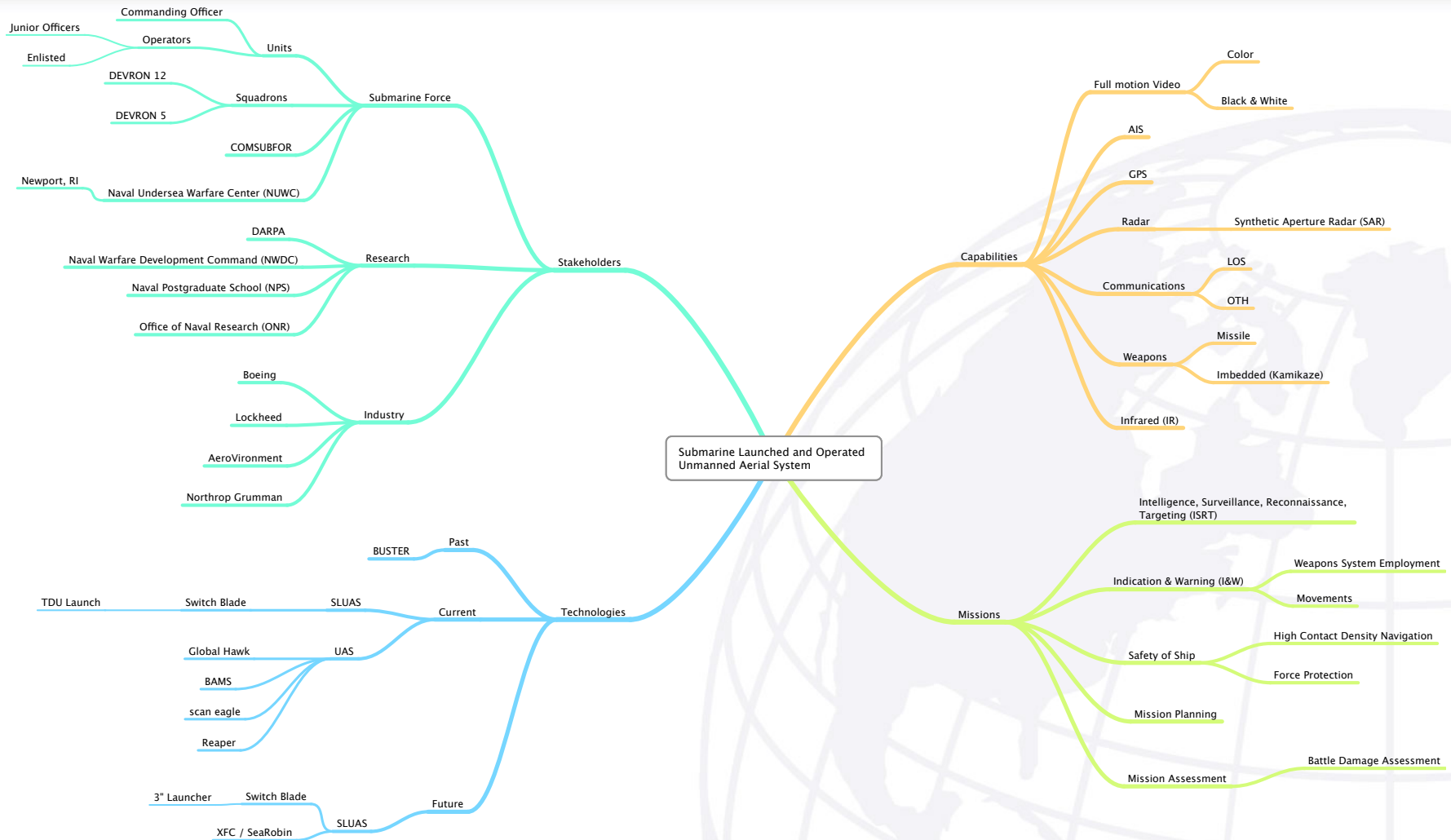
Approach

- Conduct stakeholder analysis
- Decompose desired capability enhancements
- Determine requirements
- Develop concept of operations
- Develop design
- Survey current technologies
- Conduct analysis of alternatives
- Synthesize desired UAS design
















Basic Decomposition



Unmanned Aerial Systems

DoD Unmanned Aircraft Systems (As of 1 JULY 2011)					
General Groupings	Depiction	Name	(Vehicles/GCS)	Capability/Mission	Command Level
Group 5 • > 1320 lbs • > FL180		•USAF/USN RQ-4A Global Hawk/BAMS-D Block 10 •USAF RQ-4B Global Hawk Block 20/30 •USAF RQ-4B Global Hawk Block 40	•9/3 •20/6 •5/2	•ISR/MDA (USN) •ISR •ISR/BMC	•JFACC/AOC-Theater •JFACC/AOC-Theater •JFACC/AOC-Theater
		•USAF MQ-9 Reaper	•73/85* <i>*MQ-1/MQ-9 same GCS</i>	•ISR/RSTA/EW/ STRIKE/FP	•JFACC/AOC- Support Corps, Div, Brig, SOF
Group 4 • > 1320 lbs • < FL180		•USAF MQ-1B Predator	•165/85*	•ISR/RSTA/STRIKE/FP	•JFACC/AOC-Support Corps, Div, Brig
		•USA MQ-1 Warrior/MQ-1C Gray Eagle	•31/11	•(MQ-1C Only-C3/LG)	•NA
		•USN UCAS- CVN Demo	•2/0	•Demonstration Only	•NA
		•USN MQ-8B Fire Scout VTUAV	•14/8	•ISR/RSTA/ASW/ ASUW/MIW/OMCM/ EOD/FP	•Fleet/Ship
Group 3 • < 1320 lbs • < FL180 • < 250 knots		•USA MQ-5 Hunter	•45/21	•ISR/RSTA/BDA	•Corps, Div, Brig
		•USA/USMC/SOCOM RQ-7 Shadow	•368/265	•ISR/RSTA/BDA	•Brigade Combat Team
		•USN/USMCSTUAS	•0/0	•Demonstration	•Small Unit
Group 2 • 21-55 lbs • < 3500 AGL • < 250 knots		•USN/SOCOM/USMC RQ-21A ScanEagle	•122/13	•ISR/RSTA/FORCE PROT	•Small Unit/Ship
Group 1 • 0-20 lbs • < 1200 AGL • < 100 knots		•USA / USN / USMC / SOCOM RQ-11 Raven	•5628/3752	•ISR/RSTA	•Small Unit
		•USMC/ SOCOM Wasp	•540/270	•ISR/RSTA	•Small Unit
		•SOCOM SUAS AECV Puma	•372/124	•ISR/RSTA	•Small Unit
		•USA gMAV / USN T-Hawk	•270/135	•ISR/RSTA/EOD	•Small Unit

