# Abbreviations and Acronyms

**Abbreviations: Acronyms [Rev 80A] 09212020**

The following terms are common to the UAS industry, general literature, or conferences on UAS/UAV/Drone/UUV systems.

### A-STAR
- Heuristic search algorithm discussed in chapter 9

### A2 / AD
- Anti-access / Area Denial

### A / Aref
- Amplitudes of source and reference points, see Eq-20-6,7

### AA
- Anti-aircraft / Adaptive Antennas

### AAA
- Anti-aircraft artillery

### AAIB
- Air Accidents Investigation Board

### AAM
- Air-to-air missile

### AAV
- Autonomous air vehicle

### ABI
- Aviation Block Infrastructure

### ABMS
- Advanced battle management system

### A/C
- Aircraft

### ACAS
- Airborne collision avoidance system / Assistant Chief of the Air Staff

### ACL
- Agent communication language / Autonomous control levels

### ACOUSTIC
- Detects drones by recognizing unique sounds produced by their motors

### ACRP
- Airport Cooperative Research Project

### ACS
- Airborne (defense) control station (system)

### ACTD
- Advanced Concept Technology Demonstration

### AD
- Air Defense / Ansar Dine terrorist group

### A/D
- Attack / Defense Scenario Analysis

### ADAC
- Automated Dynamic Airspace Controller

### ADAPs
- Adaptive compute acceleration platforms

### ADC
- Air data computer

### ADF
- Automatic direction finder/finding
ADMS     Air defense missile (radar) system
ADS      Air Defense System (USA)
ADS-B    Automatic Dependent Surveillance – Broadcast systems
ADT      Air Data Terminal
AES      Active electronically scanned array
AEW      Airborne early warning
AF       Adaptive Filtering
AFCS     Automatic flight control system
AFRICOM  US Africa Command
AGL      Above ground level
AGM      Air-to-surface missile
AGARD    Advisory Group for Aerospace Research and Development (NATO)
AGM-65   Maverick (USA) is an air-to-surface missile (AGM) designed for close air support. It is the most widely produced precision-guided missile in the Western world, and is effective against a wide range of tactical targets, including armor, air defenses, ships, ground transportation and fuel storage facilities.
AGV      Autonomous Guard Vehicle
AHA      Autopilot Hardware Attack
AHD      Analog high definition
AHRS     Attitude and heading reference system
AI       Artificial intelligence: “1. a branch of computer science dealing with the simulation of intelligent behavior in computers and 2: the capability of a machine to imitate intelligent human behavior.” (Merriam-Webster, 2020)
AIAA     American Institute of Aeronautics and Aerospace
AIC      Aeronautical Information Circular
AIP      Aeronautical Information Publication
AIS      Automated Identification System for Collision Avoidance
AJ       Anti-Jam
ALB      Air Land Battle
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALERT</td>
<td>Advanced Low-observable Embedded Reconnaissance Targeting system.</td>
</tr>
<tr>
<td>AM</td>
<td>Amplitude Modulation / al-Mourabitoun terrorist group</td>
</tr>
<tr>
<td>AMB</td>
<td>Agile Multi-Beam</td>
</tr>
<tr>
<td>AMRAAM</td>
<td>Advanced Medium-Range Air-to-Air Missile</td>
</tr>
<tr>
<td>ANSP</td>
<td>Air Navigation Service Provider</td>
</tr>
<tr>
<td>ANO</td>
<td>Air Navigation Order (UK)</td>
</tr>
<tr>
<td>AO</td>
<td>Area of Operations</td>
</tr>
<tr>
<td>AoA</td>
<td>Angle of Attack</td>
</tr>
<tr>
<td>APEC</td>
<td>Asia Pacific Economic Cooperation</td>
</tr>
<tr>
<td>APG</td>
<td>Asia-Pacific Gateway</td>
</tr>
<tr>
<td>APKWS</td>
<td>Advanced precision kill weapon system</td>
</tr>
<tr>
<td>AQ</td>
<td>Al-Qaeda Terrorist Group – “the Base”</td>
</tr>
<tr>
<td>AOA</td>
<td>Aircraft operating authority</td>
</tr>
<tr>
<td>AQIM</td>
<td>al-Qaeda in the Islamic Maghreb</td>
</tr>
<tr>
<td>Ar</td>
<td>Receive antenna effective area, m²</td>
</tr>
<tr>
<td>AR</td>
<td>Aspect ratio</td>
</tr>
<tr>
<td>AR drone</td>
<td>AR stands for “Augmented Reality” in AR drone. AR Drone can perform tasks like object recognition and following, gesture following.</td>
</tr>
<tr>
<td>ARM</td>
<td>Anti-Radiation Munitions</td>
</tr>
<tr>
<td>ARS</td>
<td>Airborne Remote Sensing</td>
</tr>
<tr>
<td>ART</td>
<td>Autonomous Rail Transport</td>
</tr>
<tr>
<td>ARW</td>
<td>Anti-radiation weapons</td>
</tr>
<tr>
<td>AS</td>
<td>Airborne Sensing Systems</td>
</tr>
<tr>
<td>ASB</td>
<td>Advisory Service Bulletin / Air Sea Battle</td>
</tr>
<tr>
<td>ASBM</td>
<td>Anti-ship ballistic missile</td>
</tr>
<tr>
<td>ASCM</td>
<td>Anti-ship cruise missile</td>
</tr>
<tr>
<td>ASEA</td>
<td>Active electronically scanned arrays</td>
</tr>
<tr>
<td>ASEAN</td>
<td>Association of Southeastern Asian Nations</td>
</tr>
<tr>
<td>ASICs</td>
<td>Application specific integrated Circuits &amp; circuit boards</td>
</tr>
<tr>
<td>ASL</td>
<td>Airborne Systems Laboratory</td>
</tr>
<tr>
<td>ASMS</td>
<td>Automated Separation Management System</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>ASR</td>
<td>Chinese Air Silk Road</td>
</tr>
<tr>
<td>ASOS</td>
<td>Automated surface weather observation system</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society of Testing and Materials (ASTM)</td>
</tr>
<tr>
<td>ASTER</td>
<td>Agency for Science, Technology and Research</td>
</tr>
<tr>
<td>ASuW</td>
<td>Anti-surface unit warfare</td>
</tr>
<tr>
<td>ASW</td>
<td>Anti-submarine warfare</td>
</tr>
<tr>
<td>AT</td>
<td>Aerial target</td>
</tr>
<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
</tr>
<tr>
<td>ATHENA</td>
<td>Lockheed Martin Advanced Test High Energy Asset</td>
</tr>
<tr>
<td>ATM</td>
<td>Air Traffic Management</td>
</tr>
<tr>
<td>ATN</td>
<td>Aids to Navigation (aka ATON)</td>
</tr>
<tr>
<td>ATR</td>
<td>Automatic Target Recognition</td>
</tr>
<tr>
<td>ATS</td>
<td>Air Traffic Service</td>
</tr>
<tr>
<td>AUDS</td>
<td>Anti-UAV Defense System</td>
</tr>
<tr>
<td>AUV</td>
<td>Autonomous Underwater Vehicle</td>
</tr>
<tr>
<td>Avionics</td>
<td>Aviation electronics in manned or unmanned aircraft</td>
</tr>
<tr>
<td>AUVSI</td>
<td>Association for Unmanned Vehicle Systems</td>
</tr>
<tr>
<td>B</td>
<td>IF equivalent bandwidth, Hz</td>
</tr>
<tr>
<td>Backhauling</td>
<td>Intermediate links between core network or internet backbone and small subnets at the edge of the network</td>
</tr>
<tr>
<td>BAMS</td>
<td>Broad Area maritime surveillance</td>
</tr>
<tr>
<td>BATS</td>
<td>Bermuda Atlantic Time-series Study</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>Defined as the Range within a band of wavelengths, frequencies, or energy. Think of it as a range of radio frequencies occupied by a modulated carrier wave, assigned to a service over which a device can operate. Bandwidth is also a capacity for data transfer of electrical communications system.</td>
</tr>
<tr>
<td>BDA</td>
<td>Battle Damage assessment</td>
</tr>
<tr>
<td>BER</td>
<td>Bit error rate</td>
</tr>
<tr>
<td>BLOS</td>
<td>Beyond line-of-sight</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>BNF</td>
<td>Bind and Fly – with custom transmitter</td>
</tr>
<tr>
<td>BPAUV</td>
<td>Battlespace preparation autonomous underwater vehicle</td>
</tr>
<tr>
<td>BRI</td>
<td>Chinese Belt and Road Initiative</td>
</tr>
<tr>
<td>BR&amp;T</td>
<td>Boeing Research and Technology</td>
</tr>
<tr>
<td>BSR</td>
<td>Bilinear Signal Representation</td>
</tr>
<tr>
<td>BSs</td>
<td>Base Stations</td>
</tr>
<tr>
<td>BVR</td>
<td>Beyond visual range</td>
</tr>
<tr>
<td>c</td>
<td>Speed of light ~ (3 x 10^8 m/s) [186,000 miles per sec] in vacuum named after Celeritas the Latin word for speed or velocity</td>
</tr>
<tr>
<td>c</td>
<td>Speed of sound (344 m/s) in air</td>
</tr>
<tr>
<td>C</td>
<td>Combined methods of CR</td>
</tr>
<tr>
<td>C2 / C2W</td>
<td>Command and control / Command and Control Warfare</td>
</tr>
<tr>
<td>C3I</td>
<td>Command, control, communications, and Intelligence</td>
</tr>
<tr>
<td>C4</td>
<td>Command, control, communications, and computers</td>
</tr>
<tr>
<td>C4I</td>
<td>Command, control, communications and computers, intelligence</td>
</tr>
<tr>
<td>C4ISR</td>
<td>Command, control, communications, computers, intelligence, surveillance &amp; reconnaissance</td>
</tr>
<tr>
<td>C4ISTAR</td>
<td>Command, control, communications, computers, intelligence, surveillance, target acquisition and reconnaissance</td>
</tr>
<tr>
<td>CA</td>
<td>Collision Avoidance / Clear Acquisition (GPS) / Cyber Assault (aka CyA)</td>
</tr>
<tr>
<td>C/A</td>
<td>Civilian acquisition code for GPS</td>
</tr>
<tr>
<td>CAA</td>
<td>Control Acquisition cyber attack</td>
</tr>
<tr>
<td>CAS</td>
<td>Close Air Support / Common situational awareness</td>
</tr>
<tr>
<td>CASA</td>
<td>Civil Aviation Safety Authority</td>
</tr>
<tr>
<td>CASIC</td>
<td>China Aerospace Science and Industry Corporation</td>
</tr>
<tr>
<td>C of A</td>
<td>Certificate of Airworthiness</td>
</tr>
<tr>
<td>CAP</td>
<td>Civil Air Publication</td>
</tr>
</tbody>
</table>
CAT  Collision Avoidance Threshold /Connectivity & automation in transport
CC /CyC   Cyber Crime
CCE   Cyber Counter Espionage
CCI   Command control interface / Cyber Counterintelligence
CCMPS Cooperative Cognitive Maritime Cyber Physical System
CCS   Cyber Counter Sabotage
CCT   Cyber Counter Terrorism
CC-UAS Counter-Counter Unmanned Aircraft Systems
CD   Conflict Detection
CDL   Common datalink
CDMA   code division multiple access
CDR   Collision detection and resolution systems (automated SAA in UAS)
CEA   Cyber electromagnetic activities (Cyber, EW, Spectrum warfare)
CETC   Chinese Electronics Technology Group
CF   Computer Forensics
CFTA   Continental Free Trade Area
CFT Certificate of flight trials / Cross-functional teams
CHIMERA   Counter-electronic HPM Extended range base air defense
CI /Cyi   Cyber Infiltration
CIA  Confidentiality, Integrity, Availability / Central Intelligence Agency
CIAD   Cyber- Multi-layered Integrated Air Defense Systems
CIED   Computer improvised explosive device
CIN   Common Information Network
CIR  Color Infrared – artificial standard where NIR bands shifted so that humans can see the infrared reflectance

Abbreviations and Acronyms
CLE  Airport code for Cleveland

C/N  Carrier to Noise ratio in HAPS, => C/ N0

C/NA  Communication / Navigation Aid

CM / CyM  Countermeasure / Cyber Manipulation

CN3  Communications / navigation network node

CNI  Critical National Infrastructure

CNKI  China-North Korea-Iran technical weapons cooperation agreements

CNO  Chief Naval Operations

CNPC  Control and non-payload links

COA  Certificate of Waiver or Authorization

COB  Chief of the Boat

COMINT  Communications intelligence

COMJAM  Communications Jamming

COMSEC  Communications Security

CONOP(S)  Concepts of Operations

CONUS  Continental United States

COOP  Cooperative Observer Program

COS  Continued Operational Safety

COTS  Commercial off-the-shelf

CPA  Closest Point of Approach

CPA Spoof  CPA spoof involves faking a possible collision with a target ship

CPL  Commercial pilot’s license

CPNI  Center for Protection of National Infrastructure (UK)

CPRC  Communist Party of the Republic of China

CPS  Cyber-physical systems

CR  Conflict Resolution / Close range / Cyber Raid (aka CyR)

CRH  Coaxial rotor helicopter

CRX  Received Signal Power, watts

CS  Control station

CSDP  Common Security and Defense Policy missions (EU)

CSR  Compact Surveillance Radar

Abbreviations and Acronyms | lvii
CSfC  Commercial Solutions for Classified Program  
CSIRO  Commonwealth Scientific and Industrial Research Organization  
CT  Counter Terrorism / Counter Terrorism Mission  
CTOL  Conventional take-off and landing  
C-UAS  Counter Unmanned Aircraft Systems (defenses / countermeasures)  
CUAS  CSIRO Unmanned Aircraft Systems  
CV  Collision Volume  
CW / CyW  Cyber Warfare  
D–STAR  Variation of A-STAR algorithm suitable for solving path planning problems in unknown environments  
\( D \)  distance from transmitter in Range equation (Adamy D. -0., 2015)  
DA  Danger area  
Danger Close  
Definition  [www.benning.army.mil/infantry/magazine/issues/2013/May-June/Myer.html](www.benning.army.mil/infantry/magazine/issues/2013/May-June/Myer.html)  
Nov 14, 2013 – 1) danger close is included in the “method-of-engagement” line of a call-for-fire request to indicate that friendly forces are close to the target. … Danger close is a term that is exclusive from risk estimate distance (RED) although the RED for 0.1 percent PI is used to define danger close for aircraft delivery. \( \text{PI} = \text{Probability of incapacitation.} \)  
2) Definition of “danger close” (US DoD) In close air support, artillery, mortar, and naval gunfire support fires, it is the term included in the method of engagement segment of a call for fire which indicates that friendly forces are within close proximity of the target.  
DARO  Defense Airborne Reconnaissance Office  
DARPA  Defense Advanced Research Projects Agency  
DAS  Detection by Acoustical Signature  
\( \text{dB} \)  decibels  
DC  Direct Current  
DCL  Drone Champions League  
DCPA  Distance between vessels approaching CPA
DDD Dull, dangerous, and dirty
DDOS Distributed Denial of Service cyber attack
DE Directed Energy
DEF CON DEF CON is the world's longest running and largest underground hacking conference.
DE / EP Directed energy / Electromagnetic pulse
DEM Digital elevation model
DEW Directed energy weapons
DF Direction finding
DFCS Digital Flight Control System
DHS Department of Homeland Security
DIME Diplomatic, information, military, and economy
DIRCM Directed Infrared Countermeasures
DIY Do-it-yourself (amateur built drones or modified racing drones)

DJ Jammer location – to-target receiver location distance, in km, FM 34-40-7
DJ Data Jamming / Drone Jammer
DJI Popular and functional Chinese made drone series: Mavic, Phantom, Ryze, Matrix, Spark, Enterprise, Inspire, Tello {However, banned by USA Army} (Newman, 2017)
DL Downlink in HAPS
DLA Date last accessed (usually a web reference)
DLI Datalink interface
DNA Deoxyribonucleic acid
DoD Department of Defense
DOF Degrees of Freedom
DVL Doppler velocity log
DOS Denial of Service cyber attack
DPM Direct power management / Dynamic Power Management
DPRK Democratic People’s Republic of Korea
D-R-O-N-E FAA Guidance: Direct, Report, Observe, Notice &Execute
DROV Remote operating vehicle
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSA</td>
<td>Detect, sense and avoid / Dynamic Sense-and-Act</td>
</tr>
<tr>
<td>DSR</td>
<td>Chinese Digital Silk Road</td>
</tr>
<tr>
<td>DSS</td>
<td>Decision Support System</td>
</tr>
<tr>
<td>DSSS</td>
<td>Direct sequence spread spectrum</td>
</tr>
<tr>
<td>Dt</td>
<td>Enemy transmitter location -to- target receiver location, in km, FM 34-40-7</td>
</tr>
<tr>
<td>DT</td>
<td>Directional transmission / Department of Transport (UK)</td>
</tr>
<tr>
<td>DTDMA</td>
<td>Distributed Time Division Multiple Access (DTDMA) network radio system</td>
</tr>
<tr>
<td>DTED</td>
<td>Digital terrain evaluation data</td>
</tr>
<tr>
<td>DTF</td>
<td>Drug Task Force</td>
</tr>
<tr>
<td>DTH</td>
<td>Direct-To-Home</td>
</tr>
<tr>
<td>DTI</td>
<td>Direct Track &amp; Identify</td>
</tr>
<tr>
<td>DTRA</td>
<td>Defense Threat Reduction Agency</td>
</tr>
<tr>
<td>DUO</td>
<td>Designated UAS operator</td>
</tr>
<tr>
<td>EA</td>
<td>Electronic Attack</td>
</tr>
<tr>
<td>EARSC</td>
<td>European Association of Remote Sensing Companies</td>
</tr>
<tr>
<td>EAS</td>
<td>Equivalent airspeed</td>
</tr>
<tr>
<td>EAU</td>
<td>East Africa union comprising of Israel and six East African states, Kenya, Ethiopia, Tanzania, Uganda, Rwanda, and South Sudan</td>
</tr>
<tr>
<td>(Eb / No)</td>
<td>Thermal noise power spectral density ratio</td>
</tr>
<tr>
<td>ECCM / EP</td>
<td>Electronic counter-countermeasures / Electronic Protection</td>
</tr>
<tr>
<td>ECM</td>
<td>Electronic countermeasures</td>
</tr>
<tr>
<td>ECR</td>
<td>Electronic combat reconnaissance</td>
</tr>
<tr>
<td>EDC</td>
<td>Estimated Date of Completion</td>
</tr>
<tr>
<td>EDEW</td>
<td>Effects of Directed Energy Weapons</td>
</tr>
<tr>
<td>EEZP</td>
<td>Exclusive economic Zone protection</td>
</tr>
<tr>
<td>EFF</td>
<td>Electronic Frontier Foundation</td>
</tr>
<tr>
<td>EHS</td>
<td>Enhanced surveillance</td>
</tr>
<tr>
<td>EIRP</td>
<td>Effective isotopic radiated power</td>
</tr>
<tr>
<td>Electrolaser</td>
<td>Electroshock weapon that is also a DEW. Uses lasers to form electrically conductive laser-induced plasma charge</td>
</tr>
</tbody>
</table>
ELINT  Electronic Intelligence
ELT   Emergency locator transmitter
ECM   Electromagnetic compatibility
EM    Electromagnetic
EMC   Electromagnetic compatibility
EME   Electromagnetic environment
EMI   Electromagnetic interference
EMO   Electromagnetic operations
EMP   Electromagnetic pulse
EMR   Electromagnetic Radiation
EMS   Electromagnetic Spectrum
EMSVIS Electromagnetic Spectrum Visible Light
EMW   Electromagnetic Waves
EO    Electro-optical (sensing) / Earth Observation
EOTS  Electro-optical targeting system
EPIRB Emergency Positioning - Indicating Radio Beacon
EQUAS Explainable question answering system
ERPJ  Effective radiated power of the jammer, in dBm
ERPS  Effective radiated power of the desired signal transmitter, in dBm
ESM / ES Electronic support measures / Electronic warfare support / Earth station & ESM Electronic Signal Monitoring
EU    European Union
EUNAVFOR European Union Naval Force’s anti-piracy naval mission
EUTM  Somalia Military training mission in Somalia
EVTOL Electric Vertical Take-off and Landing
EW    Electronic warfare, see 9-15 & footnotes
F     Field theory methods of CR
F     Fundamental frequency is defined as the lowest frequency of a periodic waveform
f     Frequency, cycles / second RRE
Fo    Resonant frequency of string, Hz see Eq. 20-5
F     Frequency in MHz, FM 34-40-7
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
</tr>
<tr>
<td>FACE</td>
<td>Future Airborne Capability Environment</td>
</tr>
<tr>
<td>FAR</td>
<td>False Alarm Rates</td>
</tr>
<tr>
<td>FBL</td>
<td>Fly-by-Light, a type of flight-control system where input command signals are sent to the actuators through the medium of optical-fiber ...</td>
</tr>
<tr>
<td>FBW</td>
<td>Fly-by-wire</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
</tr>
<tr>
<td>FCS</td>
<td>Flight control systems / Flight Control Station</td>
</tr>
<tr>
<td>FDF</td>
<td>Frequency Domain Filtering</td>
</tr>
<tr>
<td>FDM</td>
<td>frequency division multiplexing</td>
</tr>
<tr>
<td>FHSS</td>
<td>Frequency hopping spread spectrum</td>
</tr>
<tr>
<td>FIIP</td>
<td>Floating Integrated Information Platforms</td>
</tr>
<tr>
<td>FIR</td>
<td>Far Infrared (25-40) to (200-350) um</td>
</tr>
<tr>
<td>FIRES</td>
<td>definition (US DoD – JP 3-0) the use of weapon systems to create a specific lethal or nonlethal effect on a target.</td>
</tr>
<tr>
<td>FL</td>
<td>Flight Level</td>
</tr>
<tr>
<td>FLIR</td>
<td>Forward-looking infrared</td>
</tr>
<tr>
<td>Fly-by-Wire</td>
<td>Predetermine flight mission path based on GPS coordinates</td>
</tr>
<tr>
<td>Floats</td>
<td>Floating sensors (USN)</td>
</tr>
<tr>
<td>FMS</td>
<td>Flexible manufacturing system</td>
</tr>
<tr>
<td>Follow-Me</td>
<td>UAS autopilot automatically follows operator</td>
</tr>
<tr>
<td>Fom</td>
<td>HAPS Figure of merit in upload /download link</td>
</tr>
<tr>
<td>FoV</td>
<td>Field of view</td>
</tr>
<tr>
<td>FFOV</td>
<td>Forward Field of View</td>
</tr>
<tr>
<td>FRAGO</td>
<td>Fragmentary Order – to send timely changes of existing orders to a subordinate</td>
</tr>
<tr>
<td>FPV</td>
<td>First Person View – live streaming video used in racing drones</td>
</tr>
<tr>
<td>FPGA</td>
<td>Field programmable gate array</td>
</tr>
<tr>
<td>FS</td>
<td>Fixed service</td>
</tr>
<tr>
<td>FSS</td>
<td>Fixed satellite service</td>
</tr>
<tr>
<td>FW</td>
<td>Fixed wing</td>
</tr>
<tr>
<td>FY</td>
<td>Fiscal year</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>G</td>
<td>Geometric methods of CR</td>
</tr>
<tr>
<td>G5S</td>
<td>G5 Sahel (G5S) Joint Force, has membership of five states: Burkina Faso, Mali, Mauritania, Niger, and Chad</td>
</tr>
<tr>
<td>GAO</td>
<td>General Accounting Office USA</td>
</tr>
<tr>
<td>gAR</td>
<td>Receiving Antenna Gain as a Factor</td>
</tr>
<tr>
<td>GBU</td>
<td>Guided Bomb Unit</td>
</tr>
<tr>
<td>GCHQ</td>
<td>Government Communications Headquarters (Britain)</td>
</tr>
<tr>
<td>GCS</td>
<td>Ground control station</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product (USA)</td>
</tr>
<tr>
<td>GDPR</td>
<td>European Union's (EU) General Data Protection Regulation</td>
</tr>
<tr>
<td>GDT</td>
<td>Ground data terminal</td>
</tr>
<tr>
<td>GEO</td>
<td>Geostationary Earth orbit satellite</td>
</tr>
<tr>
<td>GEOINT</td>
<td>Geospatial-Intelligence</td>
</tr>
<tr>
<td>GeoFence</td>
<td>A geo-fence is a virtual perimeter for a real-world geographic area</td>
</tr>
<tr>
<td>GIGO</td>
<td>Garbage in, garbage out</td>
</tr>
<tr>
<td>GLOW</td>
<td>Gross lift-off weight for a missile / rocket</td>
</tr>
<tr>
<td>GNSS</td>
<td>Global Navigation Satellite System</td>
</tr>
<tr>
<td>GLONASS</td>
<td>Global Satellite Navigational System</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System / Geo Fencing</td>
</tr>
<tr>
<td>GPS/INS</td>
<td>Use of GPS satellite signals to correct or calibrate a solution from an inertial navigation system (INS). The method is applicable for any GNSS/INS system.</td>
</tr>
<tr>
<td>GPSSPOOF</td>
<td>Hack of GPS system affecting UAS commands</td>
</tr>
<tr>
<td>GPWS</td>
<td>Ground proximity warning system</td>
</tr>
<tr>
<td>G R</td>
<td>The receiving antenna gain in the direction of the desired signal transmitter, dBi</td>
</tr>
<tr>
<td>G RJ</td>
<td>Receiving antenna gain in the direction of the jammer, in dBi</td>
</tr>
<tr>
<td>GS</td>
<td>Ground segment of HAPs</td>
</tr>
<tr>
<td>GSE</td>
<td>Ground support equipment</td>
</tr>
<tr>
<td>GSHM</td>
<td>Ground Station Handover Method</td>
</tr>
<tr>
<td>GSM</td>
<td>Global System for Mobile Communications</td>
</tr>
</tbody>
</table>

Abbreviations and Acronyms | lxiii
GT  Game Theory methods of CR
G/T  ratio of the receive antenna gain to system noise temperature
(G /Ts) dB  Represents the figure of merit of the HAPS receiver, in dB
GT  Gain of the transmit antenna, dB
GTA  Ground -to -Air Defense
Hard damage DEW complete vaporization of a target
Harmonic  Frequency, which is an integer multiple of the fundamental frequency
H  Elevation of the jammer location above sea level, feet, FM 34-40-7
HAE  High altitude endurance
HALE  High altitude – long endurance
HAPS  High Altitude Platforms (generally for wireless communications enhancements)
HAPS UAVs  UAVs dedicated to HAPS service (example to communicate via CNPC links)
HCE  Highly contested environment
HEAT  High-explosive anti-tank warhead
HELWS  High energy laser weapon system
HITL  Human in-the-loop
HMI  Human machine interface
HO  Home Office (UK)
HPA  High power amplifier
HPL  High powered laser weapon
HPM  High powered microwave defense
Ht  Elevation of enemy transmitter location above sea level, in feet, FM 34-40-7
HUD  Heads-up display
Human  “a bipedal primate mammal (Homo sapiens), a person” (Merriam-Webster, 2020); Humanity “the quality or state of being human.” (Merriam-Webster, 2020)
Humanoids  “a humanoid being: a nonhuman creature or being
with characteristics (such as the ability to walk upright) resembling those of a human.”

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUMINT</td>
<td>Human intelligence (spy's)</td>
</tr>
<tr>
<td>HVT</td>
<td>High value target (generally, for assassination)</td>
</tr>
<tr>
<td>I</td>
<td>Sound intensity, $W \times m^{-2}$ [Source strength $S / 4\pi r^2$]</td>
</tr>
<tr>
<td>IA</td>
<td>Information Assurance / Intentional cyber warfare attack</td>
</tr>
<tr>
<td>I-actors</td>
<td>Intentional Cyber Actors</td>
</tr>
<tr>
<td>IADS</td>
<td>Multi-layered integrated air defense systems</td>
</tr>
<tr>
<td>IAI</td>
<td>Israeli Aerospace Industries</td>
</tr>
<tr>
<td>IAS</td>
<td>Indicated airspeed</td>
</tr>
<tr>
<td>ICAO</td>
<td>International Civil Aviation Organization</td>
</tr>
<tr>
<td>I.C.B.C</td>
<td>International Center for Boundary Cooperation (China)</td>
</tr>
<tr>
<td>ICBM</td>
<td>Intercontinental Ballistic Missiles</td>
</tr>
<tr>
<td>ICGs</td>
<td>Information centers of gravity</td>
</tr>
<tr>
<td>ICS</td>
<td>Internet Connection Sharing / Industrial control systems</td>
</tr>
<tr>
<td>ID</td>
<td>Information Dominance / Inspection and Identification</td>
</tr>
<tr>
<td>IEDs</td>
<td>Improvised Explosive Devices</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>IETM</td>
<td>Interactive Electronic Maintenance Manuals</td>
</tr>
<tr>
<td>IEWS</td>
<td>Intelligence, electronic warfare, and sensors</td>
</tr>
<tr>
<td>IFF</td>
<td>Identification, friend, or foe</td>
</tr>
<tr>
<td>IFR</td>
<td>Instrument flight rules</td>
</tr>
<tr>
<td>I&amp;I</td>
<td>Interchangeability and Interoperability</td>
</tr>
<tr>
<td>IIT</td>
<td>Intentional Insider Threats</td>
</tr>
</tbody>
</table>

Imaging Sensors ARS sensors that build images

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL</td>
<td>Intensity level of sound measured, dB, Eq. 20-2</td>
</tr>
<tr>
<td>IMINT</td>
<td>Imagery intelligence</td>
</tr>
<tr>
<td>IMM</td>
<td>Interacting–multiple–models tracker</td>
</tr>
<tr>
<td>IMU</td>
<td>Inertial Measurement Unit</td>
</tr>
<tr>
<td>INS</td>
<td>Inertial navigation system</td>
</tr>
</tbody>
</table>
IMU  Inertial Measurement Unit
INFOSEC  Information Security
IO  Information Operations, see Figure 9-11 & footnotes
IOB  Internet of bodies
IOC  Intergovernmental Oceanographic Commission
IOR  India Ocean Region
IoT  Internet of things
IIoT  Industrial Internet of things
IPL  Insitu Pacific Limited
IR  Infrared Sensors
IRST  Infrared search and tracking
IS  Information Superiority
ISCS  Integrated shipboard control systems
ISIS  Islamic State of Iraq and al Sham (ISIS)
ISR  Intelligence, Reconnaissance and Surveillance UAS
Platform
ISTAR  Intelligence, surveillance, target acquisition and reconnaissance
IT  Information Technology
ITU  International Telecommunications Union – Standards Organization
ITU-R  International Telecommunications Union – Radio
Sector
IW  Information Warfare
JADC2  Joint all-domain command & control
JADO  Joint all-domain operations (Thatcher, 2020)
JAGM  Joint-Air-to-Ground Missile
JAUS  Joint architecture for UAS
JDAM  Joint direct attack munitions
JFO  Joint fires observer
JP  Joint Publication – followed by military identifier
JDAM  Joint Direct Attack Munition
JNIM  Jama’at Nusrat al-Islam wal-Muslimin
JOAC  Joint Operational Access Concept
JOPES Joint Operation and Planning System / Execution System

JP Joint Publication

J / S = the ratio of the jammer power to the desired signal power at the input to the receiver being jammed in dB

JST Japan Time zone

JTAC Joint Terminal Attack Controller.

JTIDS Joint Tactical Information Distribution System (JTIDS) is an L-band DTDMA

K Boltzmann's constant (Noise component, RRE) (1.38 x 10^-23 J/K), Kelvin

K 2 for jamming frequency modulated receivers (jamming tuner accuracy), FM 34-40-7

KAMIKAZI Means “Divine Wind,” Tactic best known for Japanese suicide A/C attacks on Allied Capital Vessels in WWII. UAS TEAMS or SWARMS could be directed in the same way.

KE Kinetic energy

KEW Kinetic energy weapons

KM Katiba Macina Groups

KSU Kansas State University

L \(\lambda/2\) in Eq. 20-5

LAANC Low Altitude Authorization and Notification Capability

LASER “A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. The term “laser” originated as an acronym for “light amplification by stimulated emission of radiation”. A laser differs from other sources of light in that it emits light coherently, spatially and temporally. Spatial coherence allows a laser to be focused to a tight spot, enabling applications such as laser cutting and lithography. Spatial coherence also allows a laser beam to stay narrow over great distances (collimation), enabling applications such as laser pointers. Lasers can also have high temporal coherence, which allows them to emit light with a very narrow spectrum, i.e., they can emit a single color of light.
Temporal coherence can be used to produce pulses of light as short as a femtosecond. Used: for military and law enforcement devices for marking targets and measuring range and speed.” (Wiki-L, 2018)


Laser rangefinder Scope to assist targeting of munitions. Countermeasure: laser-absorbing paint

LGWs Laser-guided weapons
Latency Processing difference between time interval signal is transmitted and signal is received
LCDR Lieutenant Commander
L/D Lift to drag ratio
LDCM Low Duty cycle methods
LEO Low Earth Orbit Satellite / Law Enforcement Officer
LGB Laser-guided bomb, a guided bomb that uses semi-active laser guidance to strike a designated target with greater accuracy than an unguided one
LGTF Liptako-Gourma task force (LGTF) established by Burkina Faso, Mali, and Niger to secure their shared border region
LIDAR Light (Imaging) Detection and Ranging
LFS Free-Space Loss as a Factor
LIPC laser-induced plasma channel
LJ Propagation loss from jammer to receiver, in dBi
LMADIS Light Marine Air Defense Integrated System (family of C-UAS systems)
LMM Lightweight Multi-role Missile (by Thales)
LORAN-C Long Range Navigation, Revision C
LOS Line-of-sight / Loss of Signal / Loss of Separation
LOSAS Low cost Scout UAV Acoustic System
LPA Log periodic array
LPI Low Probability of Intercept
LR Long range
LRA Long range artillery
LRAD  Long Range Acoustic Device (Weapon) (Yunmonk Son, 2015)
LRCS  Low radar cross section
LRE  Launch and recovery element
LRF  Laser rangefinder
LS  Losses existing in the system (lumped together), dB
(RRE)
LS  The propagation loss from the desired signal transmitter, in dBm
LSDB  Laser Small Diameter Bomb
LST  Laser spot trackers
LTA  Lighter than Air (airship) /Low noise amplifier
LTE /LTE+  Long Term Evolution - refers to mobile telecommunications coverage
LUSV  Large Unmanned Surface Vehicles
LWIR  Long wave Infrared (sensor or camera)
M  Mass in Eq. 20-5
MA  Multi-agent methods of CR
MAD  Magnetic anomaly detection
MADIS  Marine Air Defense Integrated System
MAE  Medium-altitude endurance
MAGTF  Marine air-ground task force
MALDRONE  Malware injected into critical SAA for UAS
MALE  Medium-altitude, long endurance UAS
MALE-T  Medium altitude long endurance - tactical UAS
MAME  Medium altitude, medium endurance
MARIN  Maritime Research Institute Netherlands
MASINT  Measurement and Signal Intelligence
MATS  Mobile Aircraft Tracking System
M-AUDS  Mobile Anti-UAV Defense System
MAV  Micro-air vehicle
Maverick  AGM-65 (USA) Missile
Mesonet  network of automated weather and environmental monitoring stations designed to observe mesoscale meteorological phenomena
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCE</td>
<td>Mission control element</td>
</tr>
<tr>
<td>MCM</td>
<td>Mine countermeasures</td>
</tr>
<tr>
<td>MCU</td>
<td>Master Control Unit</td>
</tr>
<tr>
<td>MCVs</td>
<td>Mesoscale convective vortices</td>
</tr>
<tr>
<td>MDR</td>
<td>Missed Detection Rates</td>
</tr>
<tr>
<td>MEB</td>
<td>Marine expeditionary brigade (14,500 marines and sailors)</td>
</tr>
<tr>
<td>MEMS</td>
<td>Micro-electromechanical systems</td>
</tr>
<tr>
<td>MEO</td>
<td>Medium Earth Orbit satellite</td>
</tr>
<tr>
<td>MFD</td>
<td>Multi Function display</td>
</tr>
<tr>
<td>MGTOW</td>
<td>Maximum gross take-off weight</td>
</tr>
<tr>
<td>MHT</td>
<td>Multiple-hypotheses-testing</td>
</tr>
<tr>
<td>MIM</td>
<td>Man in the Middle cyber attack</td>
</tr>
<tr>
<td>MINUSMA</td>
<td>Multidimensional Integrated Stabilization Mission in Mali</td>
</tr>
<tr>
<td>MIR</td>
<td>Mid Infrared 5 to (25-40) um</td>
</tr>
<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td>ML</td>
<td>Machine learning techniques</td>
</tr>
<tr>
<td>MLRS</td>
<td>Multi launch rocket systems</td>
</tr>
<tr>
<td>MLU</td>
<td>Mid-life upgrade</td>
</tr>
<tr>
<td>MMI</td>
<td>Man-machine interface</td>
</tr>
<tr>
<td>MORS</td>
<td>Military Operations Research Society</td>
</tr>
<tr>
<td>Modulation</td>
<td>Signal Modulation is the process of varying one or more properties of a periodic waveform, called the carrier signal, with a modulating signal that typically contains information to be transmitted</td>
</tr>
<tr>
<td>MPA</td>
<td>Maritime patrol aircraft</td>
</tr>
<tr>
<td>MPI</td>
<td>Message-passing interface</td>
</tr>
<tr>
<td>MPC</td>
<td>Model-based predictive control</td>
</tr>
<tr>
<td>MPO</td>
<td>Mission payload operator</td>
</tr>
<tr>
<td>MR</td>
<td>Medium range / Maritime Reconnaissance</td>
</tr>
<tr>
<td>MRE</td>
<td>Medium-range endurance</td>
</tr>
<tr>
<td>MS</td>
<td>Mobile service</td>
</tr>
<tr>
<td>MSL / AGL</td>
<td>MSL altitudes are measured from a standard datum, which is roughly equal to the average altitude of the ocean. So, an</td>
</tr>
</tbody>
</table>
aircraft traveling 5,000 feet directly above a mountain that’s 3,000 feet tall would have an altitude of 5,000 feet Above Ground Level (AGL) and 8,000 feet MSL.

- MSR: Maritime Silk Road (China)
- MSSM: Multi-step optimization method to achieve re-planning for stealth UAV penetration of ADS
- MTCR: missile Technology Control Regime
- MTI: Moving target indication
- MTOM: Maximum take-off mass
- MTOW: Maximum takeoff weight of an aircraft at which the pilot can attempt to take off, due to structural or other limits.
- MTS: Multi Spectral Targeting System / Maritime Transportation Systems / Sector
- MTTR: Multitarget tracking radar / Mean time to repair
- MUAV: Mini-UAV or maritime UAV
- MUJAO: Movement for Unity and Jihad in West Africa
- MUM: Manned-unmanned teaming
- MUSV: Medium Unmanned Surface Vehicles
- MW: Microwave
- MWIR: Midwave Infrared
- MW: microwave towers
- N: Available Noise power, watts for HAPS
- N: Terrain and ground conductivity factor, FM 34-40-7
- 5 = very rough terrain with poor ground conductivity
- 4 = moderately rough terrain with fair to good ground conductivity
- 3 = Farmland terrain with good ground conductivity
- 2 = Level terrain with good ground conductivity

The elevation of the jammer location and the enemy transmitter location does not include the height of the antenna above the ground or the length of the antenna. It is the location deviation above sea level.

- NAC: Network Access Control
- NACA: National Advisory Committee on Aeronautics
- NAS: National Airspace (USA)
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASAMS II</td>
<td>National Advanced Surface to Air Missile System</td>
</tr>
<tr>
<td>NATO</td>
<td>North Atlantic Treaty Organization</td>
</tr>
<tr>
<td>NAV</td>
<td>Nano-air vehicle / NAV data message for GPS systems</td>
</tr>
<tr>
<td>NBC</td>
<td>Nuclear, biological, and chemical warfare</td>
</tr>
<tr>
<td>NCO</td>
<td>Network-centric operations</td>
</tr>
<tr>
<td>NCW</td>
<td>Network Centric Warfare</td>
</tr>
<tr>
<td>NDRC</td>
<td>National Development and Reform Commission (China)</td>
</tr>
<tr>
<td>NEC</td>
<td>Network enabled capability</td>
</tr>
<tr>
<td>NEMESIS</td>
<td>Netted Emulation of Multi-Element Signature against integrated Sensors (USN)</td>
</tr>
<tr>
<td>NGA</td>
<td>National Geospatial Intelligence Agency</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
</tr>
<tr>
<td>NIEM</td>
<td>National Information Exchange Model</td>
</tr>
<tr>
<td>NIR</td>
<td>near Infrared</td>
</tr>
<tr>
<td>NLOS</td>
<td>Non-line-of-sight</td>
</tr>
<tr>
<td>NM</td>
<td>Nautical Miles</td>
</tr>
<tr>
<td>NMAC</td>
<td>A NMAC is defined as an incident associated with the operation of an aircraft in which a possibility of collision occurs as a result of proximity of less than 500 feet to another aircraft, or a report is received from a pilot or a flight crewmember stating that a collision hazard existed between two or more aircraft.</td>
</tr>
<tr>
<td>NMLA</td>
<td>the National Movement for Liberation of Azawad (Tuareg Rebellion)</td>
</tr>
<tr>
<td>NO</td>
<td>Numerical Optimization methods of CR</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanographic and Atmospheric Administration</td>
</tr>
<tr>
<td>NOLO</td>
<td>No onboard live operator (USN)</td>
</tr>
<tr>
<td>NOTAM</td>
<td>Notice to airmen</td>
</tr>
<tr>
<td>NPD</td>
<td>Near Peer Doctrine</td>
</tr>
<tr>
<td>NPS</td>
<td>National Park Service</td>
</tr>
<tr>
<td>NSA</td>
<td>National Security Agency (US)</td>
</tr>
<tr>
<td>NSRL</td>
<td>New Silk Road Sea / Land routes (Chinese)</td>
</tr>
</tbody>
</table>
NTIA National Telecommunications and Information Administration

NTM/NTOM Notice to mariners

NTSB National Transportation Safety Board

NTT Non-Threat Traffic

NULLO Not using live operator (USAF)

O Other methods of CR

OEM Original Equipment Manufacturer

OIO Offensive Information Operations

OLOS Out-of-the-line-of-sight

OODA Decision Loop: Observe, Orient, Decide, Act

OoT Ocean of Things (USN) (DARPA)

ONR Office of Naval Research

OPA Optionally piloted aircraft

OPAV Optionally piloted air vehicle

OPSEC Operations Security

OSI Open systems interconnection

OT Operational technology

OTH Over-the-horizon

P Isotropic source of an electromagnetic pulse of peak power, Mw

PANCAS Passive Acoustic Non-Cooperative Collision Alert System

PB Particle Beams, Particle beams are large numbers of atomic or sub-atomic particles moving at relativistic velocities.

PCAS Persistent close air support

PCS Personal Communication Services

PEIRP Transmitter effective isotropic radiated power, watts

PFMS Predictive Flight Management System

PEMSIA Partnership in Environmental Management of the Seas of East Asia

PGB Precision guided bomb

PGM Precision guided missile
PHOTINT  Photographic intelligence (usually sky – ground)
PHX     Airport code for Phoenix
PI      Probability of Incapacitation
PII     Personal Identifiable Information
PIM     Position of intended movements/Previously intended movements
PIT     Proximity Intruder Traffic
pj      Minimum amount of jammer power output required, in watts, FM 34-40-7
PL      Power level, dB, Eq. 20-1
PLA     Chinese People’s Liberation Army
PLAN    People’s Liberation Army Navy (China)
PLC     Programmable Logic Controllers
PLOCAN  Research facility Oceanic Platform of the Canary Islands
PMIAAA  Permissions Management: Identification, Authentication and Authorization
PNF     Plug and Fly with custom transmitter, receiver, battery, and charger
PNT     Reliable communications; positioning, navigation, and timing
PO      Psychological Operations
POS     Position and Orientation System
POV     Point of View
PPP     Precise Point Positioning
PPS     Precise positioning service (GPS)
PRC     People’s Republic of China (China)
Primum Non Nocere – First Do No Harm (Latin)
PSD     Power Spectral Density
PREACT  Partnership for Regional East Africa Counterterrorism (PREACT)
PRF     Pulse repetition frequency codes
PRM     Precision Runway Monitor
PS      Pressure sensor
PSH     Plan-symmetric helicopter
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSR</td>
<td>Primary Surveillance Radar</td>
</tr>
<tr>
<td>Pt</td>
<td>Power output of the enemy drone, in watts, FM</td>
</tr>
<tr>
<td>PW/PSYWAR</td>
<td>Psychological Warfare</td>
</tr>
<tr>
<td>PWO</td>
<td>Principal Warfare officer</td>
</tr>
<tr>
<td>P(Y)</td>
<td>Precise Signal (GPS) for military positioning</td>
</tr>
<tr>
<td>QOS</td>
<td>Quality of Service in HAPs</td>
</tr>
<tr>
<td>QR</td>
<td>QR code is a type of matrix barcode which is machine or phone readable</td>
</tr>
<tr>
<td>QUAS</td>
<td>QUT UAS</td>
</tr>
<tr>
<td>QUT</td>
<td>Queensland University of Technology</td>
</tr>
<tr>
<td>R</td>
<td>1/Tb is the bit rate (b/s) in link equation</td>
</tr>
<tr>
<td>R4</td>
<td>Energy density received at detected target range, R, nm</td>
</tr>
<tr>
<td>RA</td>
<td>Resolution Advisory</td>
</tr>
<tr>
<td>RAC</td>
<td>Range air controller</td>
</tr>
<tr>
<td>RADAR</td>
<td>Radio Detection and Ranging</td>
</tr>
<tr>
<td>RADINT</td>
<td>Radar intelligence</td>
</tr>
<tr>
<td>RAM</td>
<td>Radar absorbing materials</td>
</tr>
<tr>
<td>RAS</td>
<td>Radar absorbing structure</td>
</tr>
<tr>
<td>RAST</td>
<td>Recovery, assist, and traverse</td>
</tr>
<tr>
<td>RB</td>
<td>Rule-based methods (Conflict Resolution)</td>
</tr>
<tr>
<td>RBW</td>
<td>Red-breasted Woodpecker</td>
</tr>
<tr>
<td>RCE</td>
<td>Remote Code Execution</td>
</tr>
<tr>
<td>RCO</td>
<td>Remote-control operator</td>
</tr>
<tr>
<td>RCS</td>
<td>Radar cross-section</td>
</tr>
<tr>
<td>RCTA</td>
<td>Surf Radio Technical Commission for Aeronautics</td>
</tr>
<tr>
<td>RED</td>
<td>Risk Estimate Distance</td>
</tr>
<tr>
<td>Remote ID</td>
<td>Remote ID has two meanings in this textbook. It is used as an information/technology device to identify people from a UAV. This term is used in the UAS industry and the FAA as a mechanism for identifying an aircraft type and the registrant from the ground, essentially a digital license plate and registration.</td>
</tr>
<tr>
<td>RES</td>
<td>Radio electronic systems</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
</tbody>
</table>
RGB  Red Green Blue for VIS camera
RGT  Remote ground terminal
RIAS Research Institute for Autonomous Systems
-University of North Dakota
Rician PDF  Rician probability density function
RIMPAC Rim of the Pacific Exercise – Maritime
RL  Ramp launched
RMS Reconnaissance management system / Root-mean-square
RN  Ryan-Nichols Qualitative Risk Assessment Equations
17-2, 17-3
RNRA Ryan – Nichols Attack / Defense Scenario Risk Assessment for Cyber cases
ROA  Remotely operated aircraft
ROC Republic of China (Taiwan) / Regional Operations Center (USA)
ROV/ROUV Remote operating vehicle / Remotely operated underwater vehicle
RPA  Remotely piloted aircraft
RPH  Remotely piloted helicopter
RPV  Remotely piloted vehicle
RR  Radio regulations
RRE  Radar Range Equation
RSA  RSA (Rivest–Shamir–Adelman) – authors of early public – key cryptographic system
RSTA Reconnaissance, surveillance, and target acquisition
RTA Dubai Roads and Transport Authority
RTF  Off- the- shelf, Ready -to -Fly
RTK Real Time Kinematic
RTS Remote tracking station/Request to send/Release to service
RTU Remote Terminal Unit
RUAV Relay UAV
RWR Radar warning receiver
S  Intensity at surface of sphere
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>Situational Awareness</td>
</tr>
<tr>
<td>SAA</td>
<td>Sense and Avoid &amp; Sense and Act Systems; replaces See and Avoid function of a human pilot</td>
</tr>
<tr>
<td>SAAM</td>
<td>Selective Availability Anti-Spoofing Module</td>
</tr>
<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
</tr>
<tr>
<td>SAHRV</td>
<td>Semi-autonomous Hydrographic Reconnaissance vehicle</td>
</tr>
<tr>
<td>SAM</td>
<td>Surface to Air Missile</td>
</tr>
<tr>
<td>SAMPLE</td>
<td>Survivable autonomous mobile platform, long-endurance</td>
</tr>
<tr>
<td>SAP</td>
<td>Systems Applications and Products also the name of a company</td>
</tr>
<tr>
<td>SAR</td>
<td>Synthetic aperture radar / Search and rescue—especially using helicopters</td>
</tr>
<tr>
<td>SAS</td>
<td>Safety Assurance System</td>
</tr>
<tr>
<td>SATCOM</td>
<td>Satellite communications</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervisory Control and Data Acquisition systems</td>
</tr>
<tr>
<td>SCHEMA</td>
<td>Security Incident Identification</td>
</tr>
<tr>
<td>SCIF</td>
<td>Sensitive Compartmented Information Facility</td>
</tr>
<tr>
<td>SCS</td>
<td>Shipboard control system (or station) / Stereo Camera System / South China Sea</td>
</tr>
<tr>
<td>SE</td>
<td>Synthetic environment</td>
</tr>
<tr>
<td>SEA</td>
<td>Airport code for Seattle</td>
</tr>
<tr>
<td>SEAD</td>
<td>Suppression of Enemy Air Defenses</td>
</tr>
<tr>
<td>SECDEF</td>
<td>Secretary of Defense</td>
</tr>
<tr>
<td>Shadowing</td>
<td>Airframe shadowing – UAV– Ground signal degradation during maneuver</td>
</tr>
<tr>
<td>SEZ</td>
<td>Special economic zones</td>
</tr>
<tr>
<td>SHM</td>
<td>Simple harmonic motion – represented by sign wave</td>
</tr>
<tr>
<td>SHORAD</td>
<td>Short Range Air Defense systems</td>
</tr>
<tr>
<td>SIGINT</td>
<td>Signals Intelligence</td>
</tr>
<tr>
<td>Signature</td>
<td>UAS detection by acoustic, optical, thermal and radio /radar</td>
</tr>
<tr>
<td>SINS</td>
<td>Ships inertial navigation systems</td>
</tr>
</tbody>
</table>
SJM Salafi-Jihad Movement
SKASaC Seeking airborne surveillance and control
SKYNET Fictional artificial intelligence system that becomes self-aware
SLAM Simultaneous localization and mapping
SLAMRAAM Surface launched AMRAAM
SM Separation Management
SMC Single moving camera
SME Subject matter expert
SMR Single main rotor
S/N S / N = is one pulse received signal to noise ratio, dB: Signal to Noise ratio at HAPS receiver
SOA Static Obstacle – Avoidance system
Soft damage DEW disruption to a UAS computer
SOLAS Safety of Life at Sea (International Maritime Convention)
SONAR Sound Navigation and Ranging
SPL Sound pressure level, dB = 20 Log p / po [measured pressures to reference pressure] see Eq. 20-3,4; 6-7
SPS Standard position service (GPS)
Spoofing A Cyber-weapon attack that generates false signals to replace valid ones
Spot sensors ARS sensors that measure single locations without image library
SPURV Special purpose underwater research vehicle
SQL SQL Injection – common malevolent code injection technique
SR Short range
SRBM Short range ballistic missile, ex SCUD missile
SRL Systems readiness level
SSA Static Sense-and -Act
SSBN Ballistic missile submarine force
SSP Smart Skies Project
SSR Secondary Surveillance Radar
SST Self – Separation Threshold
ST&T  Submarine Track and Trail
STANAG 4856 Standard interfaces of UAV Control System for NATO UAV

STK  Satellite tool kit
STOL  Short take-off and landing
sUAS  Small Unmanned Aircraft System
SubT  Subterranean Challenge Urban Circuit
SUAVE  Small UAV engine
SWARM  High level, dangerous collaboration of UAS, UUV, or unmanned boats
SWAT  Special Weapons and Tactics (police / paramilitary)
SWAP  Size, weight, and power
SWIR  Shortwave infrared, 1400-3000 nm, 1.4 -3.0 um wavelength range

SZ  Safety Zone is defined as the horizontal and vertical separation criteria which form a cylindrical airspace volume around the UAS. In figure 3-2 that volume is defined by 1000 ft radius and 200 ft height. It is assumed that initially the UAS is in the center with 100 ft above and below the A/C.

T  In Range equation & environment, strength of a received signal, function of square or fourth power of distance, d, from transmitter (Adamy D. -0., 2015)
T  Time, sec (RRE)
T  Tension in Eq.20-5
TA  Traffic Advisory
TAC  Target air controller
TACAN  Tactical air navigation
TAR  Antenna noise temperature, Kelvin
TAS  True airspeed
TBO  Time between overhauls
TC  Type certificate
TCAS  Traffic alert and collision avoidance system
TCPA  Time to reach Closest Point of Approach
Te  Effective input noise temperature, Kelvin,
TEAM (UAS) High level, dangerous collaboration of UAS, UUV, or unmanned boats
unmanned boats; differs from SWARM in that it has a UAS Team Leader, (TL) where SWARM does not. TL directs the UAS team and is the primary counter UAS target to disrupt.

TETRA Terrestrial Trunked Radio for terrestrial terminals / services

Thermobaric Metal augmented charge

THOR Tactical high-power operational responder

TIR Thermal infrared = 8000 – 15000 nm, 8 -15 um

TL Team Leader

TO take-off

Tort A tort is an act or omission that gives rise to injury or harm to another and amounts to a civil wrong for which courts impose liability.

TP Trajectory Prediction

TRANSCOM U.S. Transportation Command networks

TRL Technology readiness level: Technology readiness levels are a rating method developed by NASA to describe where a technology is in terms of its development. The lowest levels (1 – 3) are technologies that are being researched, the middle levels (4 – 6) are technologies that are being prototyped and tested, and the highest levels (7 – 9) are technologies that are being demonstrated and used. (NASA, 2017)

TS Measured noise temperature, Kelvin units above absolute zero

TSTCP Trans-Sahara Counterterrorism Partnership. TSCTP partners include Algeria, Burkina Faso, Cameroon, Chad, Mali, Mauritania, Morocco, Niger, Nigeria, Senegal, and Tunisia.

TT & C Telemetry, tracking and command

TUAV Tactical UAV

UA Unmanned Aircraft (non-cooperative and potential intruder)

U-Actors Unintentional Cyber Actors

UAE United Arab Emirates

UAM Urban Air Mobility (vehicle)

UAPO Unmanned Aircraft Program Office
UAS  Unmanned aircraft system
UASCmd  Unmanned aircraft system commander
UASIPP  UAS Integration Pilot Program
UAS-p  UAS pilot
UAV  Unmanned aerial vehicle
UAV-p  UAV pilot
UBR  Uplink bit rate, Mb/s
UCAR  Unmanned combat armed rotorcraft
UCARS  UAV common automated recovery system
UCAV  Unmanned combat air vehicle
UCWA / UA  Unintentional cyber warfare attack
UG  Underwater glider (USN)
UGCS  Unmanned Ground Control Station
UGS  Unmanned ground-based station
UGT  Unmanned ground transportation
UGV  Unmanned ground vehicle
UHF  Ultra High Frequency, 300 MHz – 3 GHz
UIT  Unintentional Insider Threats
UK  United Kingdom
UL  Upload link
ULC  Uniform Law Commission
ULPCG  University of Las Palmas de Gran Canaria
UMTS  Universal Mobile Telecommunications System
U.N.  United Nations
UND  University of North Dakota
UNESCO  United Nations Educational, Scientific and Cultural Organization
UNICEF  United Nations Children’s Fund
US  United States
USCG  United States Coast Guard
USCGA  United States Coast Guard Auxiliary
USD  Unmanned surveillance drone
USS  Undersea Search and Survey
USV  Unmanned surface vehicle
UTM | Unmanned Traffic Management / Safe Uniform
Traffic Management
UTV | Unmanned target vehicle
UUV | Unmanned underwater / undersea vehicle
UV | Unmanned Vehicle
UUNs / DUNs | Urgent / deliberate universal needs statements
V | Visible
VFR | Visual flight rules
VHS | Very High Frequency Radio
VIKI | Virtual Interactive Kinetic Intelligence
VLA | Very light aircraft
VLJ | Very Light Jet
VLAR | Vertical launch and recovery
VLOS | Visual Line of Sight
VMC | Visual Meteorological Conditions
VNIR | Visible light and near infrared 400 – 1400 nm, 0.4 – 1.4 μm wavelength range
Voloport | Landing site for Volcopter
VTC | Vessel traffic control
VTM | Vessel traffic management
VTOL | Vertical take-off and landing
VTUAV | Vertical take-off UAV
WABN | wide available broadband networks
WARM | identify war reserve mode emissions
WEF | World Economic Forum
WEZ | Weapon Engagement Zone
WMD | Weapons of Mass Destruction
WRC | World Radio Conference Standards Organization
XLUUV | Extra-large unmanned undersea vehicle
XO | Executive Officer of Naval vessel
ZIGBEE or KILLERBEE | Sniffing / penetration tools specific to UAS

Greek / Mathematical Symbols
\( \lambda \)  
Wavelength in Hz, \( c / f \) where \( c = \) speed of light 344 m/s and \( f = \) frequency, Hz.

\( \Sigma \)  
Radar Cross Sectional Area, m²

\( \nu \)  
UAV velocity vector and UAV speed (ms⁻¹)

\( \theta \)  
Horizontal angle in inertial axes (rad)

\( \Psi \)  
Vertical angle in inertial axes (rad)

\( x, y, z \)  
Inertial position coordinates (m)

\( \kappa \)  
Curvature (m⁻¹)

\( \tau \)  
Torsion, (m⁻¹)

\( r(q) \)  
Path, with path variable \( q \)

\( h \)  
Path length (m)

\( e \)  
Basis axes vector set

\( P(x, y, z, \theta, \Psi) \)  
UAV pose where: where \( x, y, z, \) is the UAV location or waypoint and \( (\theta, \Psi) \) are the horizontal and vertical angles, respectively

\( P_s \)  
Starting pose for UAV moving to

\( P_f \)  
Finish pose

\( \Pi \)  
Path constraint in (9.4)

\( a \)  
lateral acceleration proportional to curvature \( k \)

\( \infty \)  
vector operator in (9.6)

\( f(n) \)  
Path cost function in (9.9)

\( g(n) \)  
cost of path from start node \( n \) to the goal

\( h(n) \)  
Heuristic function which estimates the distance from the next node \( n \) on the path to goal in (9.9)

\( h(X) \)  
represents actual journey cost from goal \( X \)

\( g(X,E) \)  
represents the estimate journey cost from state \( X \) to the current position of the stealth UAV in (9.10)

\( N \)  
Length of the prediction domain in (9.11) & \( N \) steps in (9.12)

\( W \)  
length of the control domain in (9.11)

\( q_i \)  
Output prediction error

\( q_j \)  
Is the weighting coefficient of the control variable in (9.11)

\( k \)  
Kth node for prediction of cost of predicted flight path in MPC (9.12)
Special Definitions

Asymmetric warfare can describe a conflict in which the resources of two belligerents differ in essence and, in the struggle, interact and attempt to exploit each other's characteristic weaknesses. Such struggles often involve strategies and tactics of unconventional warfare, the weaker combatants attempting to use strategy to offset deficiencies in quantity or quality of their forces and equipment. (Thomas, 2010) Such strategies may not necessarily be militarized. (Stepanova, 2016)

This is in contrast to symmetric warfare, where two powers have comparable military power and resources and rely on tactics that are similar overall, differing only in details and execution. (Thomas, 2010)


Appendix 1: Standard Acoustic Principal Physical Properties (Enotokey, 2019)

and (Gelfand S. A., 2009)

A majority of the technical abbreviations come from (Nichols R. K., et al., Unmanned Aircraft Systems in the Cyber Domain, 2019) and (Nichols, et al., Counter Unmanned Aircraft Systems Technologies and Operations, 2020) Other definitions from the following references:

References


Abramson, E. (2016). Ethical Dilemmas in the Age of AI. Retrieved from Abramson, E. – knowmail.me/blog: https://www.knowmail.me/blog/ethical-dilemmas-age-ai/


Abbreviations and Acronyms | lxxxv


Angelov, P. (2012). *Sense and avoid in UAS research and applications*. Hoboken: NJ.


Atherton, K. D. (2019). *Can the Pentagon sell Silicon Valley on AI as ethical war?*. C4ISRNET.


Diversity of citizenship; amount in controversy; costs, 28 U.S. Code §1332 (United States Congress June 25, 1948).


EIA. (2019, June 20). The Strait of Hormuz is the world’s most important oil transit chokepoint. Retrieved from EIA – US Energy Information Administration: https://www.eia.gov/todayinenergy/detail.php?id=39932


Abbreviations and Acronyms | lxxxix


xc | Abbreviations and Acronyms


Toward the deph https://gcn.com/articles/2019/05/15/ethical-ai-iddc.aspx?s=gcntech_200519


xcii | Abbreviations and Acronyms
Marbury v. Madison, 5 U.S. 137 (United States Supreme Court February 23, 1803).


McCulloch v. Maryland, 17 U.S. 316 (United States Supreme Court March 6, 1819).


xciv | Abbreviations and Acronyms


Abbreviations and Acronyms | xcv


https://www.slideshare.net/ProudParas/sound-waves-loudness-and-intensity
Sovereignty and use of airspace, 49 U.S. Code §40103 (United States Congress July 5, 1994).


c | Abbreviations and Acronyms


United States Constitution Article VI, Sec.2 (United States of America September 17, 1787).


cii | Abbreviations and Acronyms
unmanned aerial vehicles: opportunities and challenges. IEEE Communications Magazine. vol. 54, no.5, pp. 36-42.


[i] FM 34-40-7