



Beginning in 2010...
Celebrating two decades of
moving the state-of-the-art in
aerial robotics forward, the AUVSI
International Aerial Robotics Competition
is proud to introduce its 6th Mission.

RULES FOR THE INTERNATIONAL AERIAL ROBOTICS COMPETITION 6th MISSION

The official World Wide Web pages for the competition are your source for all information concerning rules, interpretations, and information updates regarding the competition. In anticipation of the Competition, the official rules and application form will be obtained from the official World Wide Web pages and will not be mailed to potential competitors. If you have received these rules as a hard copy from some other source, be advised that the official source of information can be found at:

<http://iarc.angel-strike.com/>



Prize Money and some logistics funding for the International Aerial Robotics Competition (IARC) is provided by the Association for Unmanned Vehicle Systems International Foundation. Logistics funding is also supplied by various corporate and governmental sponsors.

Other sponsoring organizations and the host organization are listed at the Official IARC web site shown above.

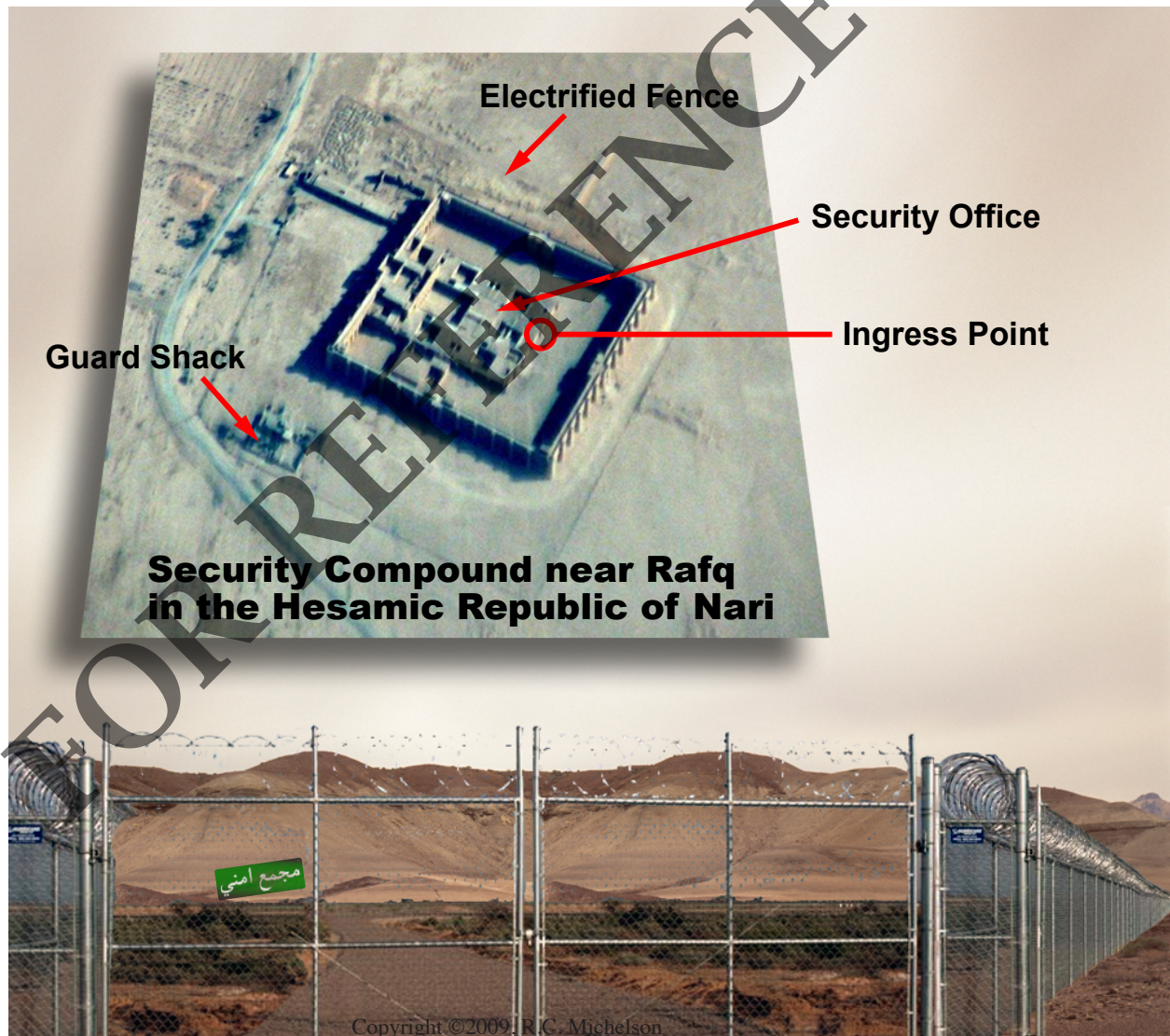
IARC MISSION 6: “Covert Operation”

Abstract

The 6th mission for the International Aerial Robotics Competition (IARC) will move the challenge to yet a higher level of autonomous aerial robotic behavior. The past two decades have seen a revolution in navigation technologies for operations in the open, but there is still much to be done in the area of indoor navigation. The goal is to create a small aerial robot capable of fully autonomous flight through a confined environment. In performing this task, the state-of-the-art in indoor navigation, vehicle design and integration, and flight control will be pushed to a higher level.

The 5th Mission of the IARC required collegiate teams to create fully autonomous flying robots capable of negotiating a rather sterile environment. The new 6th Mission picks up where the 5th Mission left off by demonstrating the fully autonomous aerial robotic behaviors necessary to more rapidly negotiate culturally-cluttered confined internal spaces of a structure once it has been penetrated by an air vehicle, and intelligently interact with physical items encountered.

Notional Mission



Credible and actionable human intelligence (HUMINT) reports have been received from a mole within the Hesamic Republic of Nari's Intelligence Organization. These reports indicate that highly sensitive information detailing plans to sabotage banking interests of a global organization may be stored in a security office located in the remote town of Rafq. A breach in security has been identified which may allow a small autonomous air vehicle to penetrate perimeter defences so that the sensitive information can be stolen by the global organization in order to preempt any actions by the Nari government which would be deemed damaging to these unnamed global interests.

Before his untimely death, the mole was able to describe a number of features within the Nari Intelligence Organization's security compound and the desired target. The following electronic communiqué is believed to contain reliable intelligence (NEC Pivot machine translation):

1. THE NARI SECURITY COMPOUND IS SURROUNDED BY RAISED TENSION [analyst: a high voltage] ELECTRIC FENCE WITH AN INNER RAZOR TELEGRAPH EXTENT [analyst: razor wire boundary or perimeter].
 2. THE BUILDING IS CONSIDERED SECURE, BUT HAS VIDEO ÅBERWKÅIN [analyst: unreadable] AT VARIOUS POINTS. VIDEO IS MONITORED BY GUARDS IN AN ADJACENT COMPOUND 300 METERS TO THE SOUTH.
 3. CERTAIN HALLWAYS INTERNAL THE SECURITY COMPOUND GET LASER "TRIP-WIRES" WHICH ABLE TO BE DEACTIVATED MANUALLY. THE LASER BEAMS, IN CASE BROKEN IN TWO, INITIATE AN LOUD HEARING [analyst: audible] ALARM.
 4. EVERYONE'S FLOORS HOLD PRESSURE-FEELING Å¼BERKIDEN [analyst: unreadable; perhaps "switches"] THAT ARE MADE TO LIVE [analyst: armed or switched on] AT THE EVENING OF EACH WORK DAY.
 5. A UNMARRIED GUARD [analyst: sole or single guard] PATROLS THE SECURITY COMPOUND ON A 10-MINUTE ROTATION. HE CAN BE SEEN WALKING ÅÜJfÅRS [analyst: unreadable] THE COMPOUND AND THEN ONCE EVERY 10 MINUTES, ENTERING THE COMPOUND FOR A SECURITY INSPECTION LASTING ABOUT 15 MINUTES. HE THEN EXITS PRESENT EIFGÅNGE THE ENCLOSURE TO Å¼BIRPRÅ¼FEN BEING EXTENT. BEGINNING THE ENCLOSURE KÅINND ONLY BEING ACHIEVED WHEN THE GUARD AM OUT. ENTRANCE WAY OUT. [analyst: entering the compound can only be achieved when the guard is outside] INGRESS/EGRESS MUST OCCUR IN BELOW 10 MINUTES TO AVOID DETECTION.
 6. THERE ARE SEVERAL OFFICES WITHIN THE COMPOUND. THE SECURITY OFFICE CAN BE FIND BY OBSERVING DIRECTIONAL SIGNS AND IS UNIQUELY IDENTIFIED BY A SIGN OVER THE DOOR.
 7. ONE TWINKLE DRIVE CONTAIN HURTFUL INFORMATION [analyst: a flash drive containing sensitive or damaging information] OF INTEREST TO OUR GLOBAL MASTERS AM OTHERWISE KEPT ON THE TOP THE LAYERS OF PAPERS IN THE CHIEF OF SECURITY'S IN-BOX EXISTING ON HIS DESK.
 8. A SINGLE UPPER STORY WINDOW IS BROKEN AND REMAINS OPEN ON THE STAGE [analyst: level or floor] BELONGING THE CHIEF OF SECURITY OFFICE.
- END OF TRANSCRIPT (RECEIVED 31 JULY 2009; NOK KUNDI SATNODE)

TASK: Penetrate the Nari Intelligence Organization's security office and remove the flash drive without detection. An identical flash drive must replace the original drive to delay detection of the missing data (see your MISSION 6 tasking orders at: http://iarc.angel-strike.com/task_orders.pdf).

The covert mission must be conducted without compromise of the organizations funding the mission, therefore no identifying markings or information that can be traced back to the organizations shall be incorporated onto or into systems which may be compromised or captured should the mission fail. The priority of mission options is as follows:

Clean Mission: Covert ingress; flash drive swap; covert egress; delivery of flash drive to your handler (Judge). Requires mission completion in under 10 minutes to avoid notice by patrolling guard.

Dirty Mission– Detection upon entry: Covert ingress fails, alarms activated; flash drive swap; rapid egress; delivery of flash drive to your handler (Judge). Vehicle has t_{mission} to complete the mission and avoid guards which have been alerted.

$$t_{\text{remaining}} = \begin{cases} 5 \text{ minutes from alarm activation} & \text{if alarm activation is at } t_{\text{mission}} < 5 \text{ minutes} \\ \text{Remainder of 10 minutes} & \text{if alarm activation is at } t_{\text{mission}} \geq 5 \text{ minutes} \end{cases}$$

Mission Failure Type 1– Failure to enter Security Compound building: Abort mission (attempt terminates).

Mission Failure Type 2– Failure to exit building in under 10 minutes (Clean Mission criteria) or in under 5 minutes (Dirty Mission criteria): Explode the air vehicle before the 10 minute/5 minute detection threshold, destroying the flash drive in the process (self destruction simulated by shutting down propulsion system either in flight or after landing while initiating a continuous audible “beeping tone”).

Mission Critical Elements

The objective will be for a team to construct a fully autonomous aerial robot capable of self controlled flight within a confined environment. The vehicle will first be required to enter the building through a one (1) square meter (or larger) opening from a designated launch area 3m away. The vehicle will have to search for a target area while avoiding unbriefed obstacles such as walls, columns, and furniture, as well as visible security systems including a scanning video camera located just outside the window entry and a laser barrier in a hallway which denies detection-free access to various offices unless manually disarmed.

The building will contain several signs indicating the route to the Chief of Security's office. Aerial robots capable of parsing these signs will have the advantage of not searching the entire facility in order to eventually come across the target (flash drive). Translation of signs that may be encountered can be referenced here: http://iarc.angel-strike.com/security_compound_signs.pdf.

The flash drive will be in the office of the Chief of Security on top of a stack of papers in an in-box on a table or desk. There will be only one flash drive. Official teams will be issued identical flash drives (sent by mail to the team point of contact upon becoming “official”) which can be used for identification and to engineer delivery, drop-off, and pick-up mechanisms. The flash drive has specifications which can be found at <http://iarc.angel-strike.com/Images/FlashDriveDimensions.jpg>.

Scanning video surveillance will be simulated by a camera with a slow blinking blue LED light. When the light is on, the camera can see the window opening; when the light is off, it is safe to enter the window. The period of the scan (blue LED) will be 30 seconds ON and 30 seconds OFF. If an aerial robot is traversing the 3 meter distance between the starting point and the window (during ingress or egress), the Judges shall deem the vehicle as having been detected. Detection by the video camera only matters upon ingress in that the time to complete the mission successfully will drop from 10 minutes (Clean Mission) to 5 minutes (Dirty Mission). Video detection upon egress simply means that the mission was not done completely covertly.

Failure to place the decoy flash drive on top of the papers in the in-box constitutes a mission that was not done completely covertly.

Activation of the alarms by breaking the laser beam in the hallway security system constitutes a mission that was not done completely covertly.

A team which delivers the flash drive within the allotted time and completely covertly will win over a team that does not complete the mission completely covertly, even if the second team completes the mission in less time.

Details about the laser barrier and how it can be deactivated are found at:

<http://iarc.angel-strike.com/BuildYourOwnLaserBarrier.pdf>

A successful attempt terminates when a team representative delivers the retrieved flash drive to any Judge in under 10 minutes for a Clean Mission or in under 5 minutes for a Dirty Mission. The aerial robot retrieving the flash drive must be beyond the 3 meter starting point before a team member can get the retrieved flash drive. This can be done by either dropping the drive while the vehicle is in a hover or in the process of landing, or a team member can manually remove the drive after the vehicle has landed in order to take it to a Judge.

An attempt terminates for any of the following: (a) if the aerial robot leaves the confines defined by the arena, (b) if a Judge needs to activate the kill switch, (c) if the vehicle lands permanently in the arena (a temporary landing will activate floor alarms, but does not terminate the attempt if the vehicle again becomes airborne in less than 15 seconds), (d) if the team reverts to manual control from autonomous control, (E) the final functional vehicle is in the opinion of the Judges, no longer able to operate in a meaningful manner.

In addition to the vehicle behavior thus described, the system must be able to provide vehicle navigational and status information to a remote JAUS-compliant terminal via the JAUS protocol (the launch point is to be considered as the origin of the vehicle's position, providing the vertical reference). (a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k) (l) (m) (n) (o) (p) (q) (r) (s) (t) (u) (v) (w) (x) (y) (z) (aa) (ab) (ac) (ad) (ae) (af) (ag) (ah) (ai) (aj) (ak) (al) (am) (an) (ao) (ap) (aq) (ar) (as) (at) (au) (av) (aw) (ax) (ay) (az) (ba) (bb) (bc) (bd) (be) (bf) (bg) (bh) (bi) (bj) (bk) (bl) (bm) (bn) (bo) (bp) (bq) (br) (bs) (bt) (bu) (bv) (bw) (bx) (by) (bz) (ca) (cb) (cc) (cd) (ce) (cf) (cg) (ch) (ci) (cj) (ck) (cl) (cm) (cn) (co) (cp) (cq) (cr) (cs) (ct) (cu) (cv) (cw) (cx) (cy) (cz) (da) (db) (dc) (dd) (de) (df) (dg) (dh) (di) (dj) (dk) (dl) (dm) (dn) (do) (dp) (dq) (dr) (ds) (dt) (du) (dv) (dw) (dx) (dy) (dz) (ea) (eb) (ec) (ed) (ee) (ef) (eg) (eh) (ei) (ej) (ek) (el) (em) (en) (eo) (ep) (eq) (er) (es) (et) (eu) (ev) (ew) (ex) (ey) (ez) (fa) (fb) (fc) (fd) (fe) (ff) (fg) (fh) (fi) (fj) (fk) (fl) (fm) (fn) (fo) (fp) (fq) (fr) (fs) (ft) (fu) (fv) (fw) (fx) (fy) (fz) (ga) (gb) (gc) (gd) (ge) (gf) (gg) (gh) (gi) (gj) (gk) (gl) (gm) (gn) (go) (gp) (gq) (gr) (gs) (gt) (gu) (gv) (gw) (gx) (gy) (gz) (ha) (hb) (hc) (hd) (he) (hf) (hg) (hh) (hi) (hj) (hk) (hl) (hm) (hn) (ho) (hp) (hq) (hr) (hs) (ht) (hu) (hv) (hw) (hx) (hy) (hz) (ia) (ib) (ic) (id) (ie) (if) (ig) (ih) (ii) (ij) (ik) (il) (im) (in) (io) (ip) (iq) (ir) (is) (it) (iu) (iv) (iw) (ix) (iy) (iz) (ja) (jb) (jc) (jd) (je) (jf) (jg) (jh) (ji) (jj) (jk) (jl) (jm) (jn) (jo) (jp) (jq) (jr) (js) (jt) (ju) (jv) (jw) (jx) (jy) (jz) (ka) (kb) (kc) (kd) (ke) (kf) (kg) (kh) (ki) (kj) (kk) (kl) (km) (kn) (ko) (kp) (kq) (kr) (ks) (kt) (ku) (kv) (kw) (kx) (ky) (kz) (la) (lb) (lc) (ld) (le) (lf) (lg) (lh) (li) (lj) (lk) (ll) (lm) (ln) (lo) (lp) (lq) (lr) (ls) (lt) (lu) (lv) (lw) (lx) (ly) (lz) (ma) (mb) (mc) (md) (me) (mf) (mg) (mh) (mi) (mj) (mk) (ml) (mm) (mn) (mo) (mp) (mq) (mr) (ms) (mt) (mu) (mv) (mw) (mx) (my) (mz) (na) (nb) (nc) (nd) (ne) (nf) (ng) (nh) (ni) (nj) (nk) (nl) (nm) (nn) (no) (np) (nq) (nr) (ns) (nt) (nu) (nv) (nw) (nx) (ny) (nz) (oa) (ob) (oc) (od) (oe) (of) (og) (oh) (oi) (oj) (ok) (ol) (om) (on) (oo) (op) (oq) (or) (os) (ot) (ou) (ov) (ow) (ox) (oy) (oz) (pa) (pb) (pc) (pd) (pe) (pf) (pg) (ph) (pi) (pj) (pk) (pl) (pm) (pn) (po) (pp) (pq) (pr) (ps) (pt) (pu) (pv) (pw) (px) (py) (pz) (qa) (qb) (qc) (qd) (qe) (qf) (qg) (qh) (qi) (qj) (qk) (ql) (qm) (qn) (qo) (qp) (qq) (qr) (qs) (qt) (qu) (qv) (qw) (qx) (qy) (qz) (ra) (rb) (rc) (rd) (re) (rf) (rg) (rh) (ri) (rj) (rk) (rl) (rm) (rn) (ro) (rp) (rq) (rr) (rs) (rt) (ru) (rv) (rw) (rx) (ry) (rz) (sa) (sb) (sc) (sd) (se) (sf) (sg) (sh) (si) (sj) (sk) (sl) (sm) (sn) (so) (sp) (sq) (sr) (ss) (st) (su) (sv) (sw) (sx) (sy) (sz) (ta) (tb) (tc) (td) (te) (tf) (tg) (th) (ti) (tj) (tk) (tl) (tm) (tn) (to) (tp) (tq) (tr) (ts) (tt) (tu) (tv) (tw) (tx) (ty) (tz) (ua) (ub) (uc) (ud) (ue) (uf) (ug) (uh) (ui) (uj) (uk) (ul) (um) (un) (uo) (up) (uq) (ur) (us) (ut) (uu) (uv) (uw) (ux) (uy) (uz) (va) (vb) (vc) (vd) (ve) (vf) (vg) (vh) (vi) (vj) (vk) (vl) (vm) (vn) (vo) (vp) (vq) (vr) (vs) (vt) (vu) (vv) (vw) (vx) (vy) (vz) (wa) (wb) (wc) (wd) (we) (wf) (wg) (wh) (wi) (wj) (wk) (wl) (wm) (wn) (wo) (wp) (wq) (wr) (ws) (wt) (wu) (wv) (ww) (wx) (wy) (wz) (xa) (xb) (xc) (xd) (xe) (xf) (xg) (xh) (xi) (xj) (xk) (xl) (xm) (xn) (xo) (xp) (xq) (xr) (xs) (xt) (xu) (xv) (xw) (xx) (xy) (xz) (ya) (yb) (yc) (yd) (ye) (yf) (yg) (yh) (yi) (yj) (yk) (yl) (ym) (yn) (yo) (yp) (yq) (yr) (ys) (yt) (yu) (yv) (yw) (yx) (yy) (yz) (za) (zb) (zc) (zd) (ze) (zf) (zg) (zh) (zi) (zj) (zk) (zl) (zm) (zn) (zo) (zp) (zq) (zr) (zs) (zt) (zu) (zv) (zw) (zx) (zy) (zz)

NOTE: All JAUS requirements have been dropped from the IARC (16 December 2010). The DoD Unmanned Systems and Robotics Interoperability Center offered resources for the student teams to help them meet the requirements of the IARC, but no longer does so. Teams must have JAUS software support if we are to mandate it as a mission requirement. While changes to the Official Rules are not tolerated, we can not continue to require teams to use an unsupported specification. This change is reflected in the scoring formula. Teams wishing to continue using JAUS protocols are free to do so.

The Judges will use an industry standard IARC-supplied JAUS-compliant terminal to assess vehicle behavior as well as JAUS compliance. Using those protocols correctly and supplying an appropriate interface to translate from the team's system to the JAUS-compliant terminal will assure that the Judges can see and interpret the aerial robot's navigational and status information. Upon becoming an "Officially Registered IARC Team," JAUS compliant protocols as well as the physical interface requirements for the Judge's JAUS-compliant terminal will be supplied.

General Rules Governing Entries

1. Vehicles must be unmanned and autonomous. They must compete based on their ability to sense the semi-structured environment of the Competition Arena. They may be intelligent or pre-programmed, but they must not be flown by a remote human operator. Any number of air vehicles may be deployed so long as the gross aggregate weight of each air vehicle does not exceed 1.50 kg.
2. Computational power need not be carried by the air vehicle. Computers operating from standard commercial power may be set up outside the Competition arena boundary and uni- or bi-directional data may be transmitted to/from the vehicles in the arena however there shall be no human intervention with any ground-based systems necessary for autonomous operation (computers, navigation equipment, links, antennas, etc.).
3. Data links will be by means of radio frequencies in any legal band for the location of the arena.
4. The air vehicle(s) must be free flying, autonomous, and have no entangling encumbrances such as tethers. The air vehicle(s) can be of any type. During flight, the maximum dimension of the air vehicle can not exceed one (1) meter. The maximum takeoff weight of the vehicle cannot exceed 1.50 kg. The vehicle must be powered by means of an electric motor using a battery, capacitor, or fuel cell as a source of energy. The vehicle must be equipped with a method of manually-activated remote override of the primary propulsion system.
5. A maximum of two (2) non-line-of-sight (NLOS) navigation aids may be used external to the designated flight area. It will be assumed that these navigation aids were positioned by a mother ship around the building (but not on top) prior to a aerial robotic sub vehicle launch. The navigation aids must be portable, and must be removed once the team leaves the competition area. GPS is not allowed as a navigation aid.
6. Upon entering the arena under autonomous control, aerial robots must remain within the bounds of the arena or the attempt will end. Vehicles leaving the arena or in the Judges' opinion, are about to leave the arena, will have their flight terminated by a Judge. Flight termination actuation will be controlled by a Judge, not the team. Each team will supply the designated Judge with its manually-actuated kill device as they enter the arena prior to their attempt(s), and must demonstrate that the kill switch is functional for the Judge. Either separate kill switches can be provided for each vehicle in multiple vehicle swarms, or a single kill switch that disables all vehicles in the swarm simultaneously is deemed acceptable.

7. The ground station equipment other than the optional navigation aids, manual kill switch mechanisms, must be portable such that it can be setup and removed from the arena quickly. A suggestion would be to setup the equipment on a roll-cart similar to that shown in Figure 1.



Figure 1. Roll-Cart.

Operations

Teams will be given four (4) flight attempts. The team with the highest static judging score will be given one (1) additional attempt. Each team will be given 15 minutes to setup their system and adjust parameters. If the team is unable to launch an aerial robot within the 15 minute window, the attempt is forfeited. Each team is granted one (1) pass. Once a set of attempts has been completed by a given team, the entire team will be required to leave the arena. No hardware may be left in place.

During the static display of the vehicle(s), the vehicle(s) will be measured to verify the 1 meter maximum dimension constraint. The vehicle(s), in takeoff configuration will be weighed to verify the 1.50 kg maximum weight restriction. The vehicle(s) will also be examined to assure that all kill switch functions are fully operational prior to flight.

Competition Area

The competition flight area (arena) will be constructed within an area that is approximately 30 m long by 15 m wide, and 2.5 m high. This area will be divided into a number of rooms and corridors with various obstacles of various heights. The launch location will be fixed at a distance of 3m and oriented toward a 1 x 1 meter (minimum) opening into a corridor. Navigation aids, if used, may be located anywhere in a 3 meter perimeter bounding the outside of the arena (see Figure 2). A list of typical materials and construction notes (which may be updated from time to time) is provided at http://iarc.angel-strike.com/IARC_Arena_Construction.pdf so that teams can construct similar practice arenas for use in refining their aerial robotic systems prior to arrival on the Competition day.

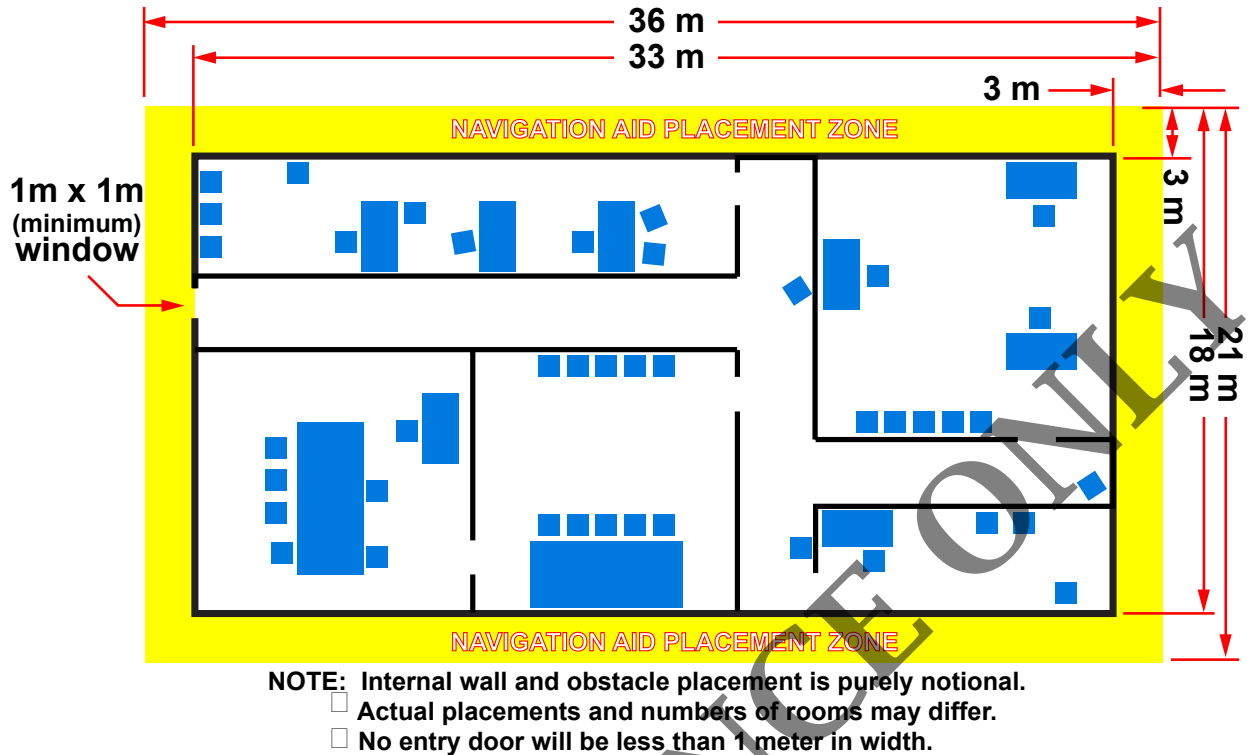


Figure 2. Arena dimensions and notional internal layout.

Making Application to Enter

So your entry form will be anticipated, and so you can be notified that it has not arrived were it to get lost in the mail, an *Intention to Compete* should be received no later than June 1 (which is the final date for new applications in any given year). To avoid unnecessary delay due to the mail (particularly for international entries), a letter of *Intention to Compete* can be transmitted by E-MAIL to Robert C. Michelson, Competition organizer, at millennialvision.llc@gmail.com. Submission of a letter of *Intention to Compete* is not a requirement, however entries received after the deadline which are not clearly postmarked may be rejected as late unless prior intention to compete has been expressed.

The official World Wide Web pages for the competition are your source for all information concerning rules, interpretations, and information updates regarding the competition. In anticipation of the upcoming event, the official rules and application form will be obtained from the official world wide web pages and will *not* be mailed to potential competitors. If you have received these rules as a hard copy from some other source, be advised that the official source of information can be found at: <http://iarc.angel-strike.com/>

The application form is available electronically at:

<http://iarc.angel-strike.com/entryform.php>

All submissions must be in English. The completed application form is not considered an official entry until a check or money order for 1000 U.S. Dollars is received by mail on or before May 1, of the current year for which a team officially enters the Competition (this is a one-time application fee). **For the American Venue**, the application fee should be sent to the attention of the Competition organizer, Robert Michelson, P.O. Box 4261, Canton, Georgia 30114, U.S.A. The application fee (in the form of a check or money order) should be made out as follows: SEPDAC Inc.† Checks or money orders made out to any name other than “SEPDAC Inc.” will be returned.

For the Asia/Pacific Venue, RMB Account: 户名 (in A/C with) : 中国航空学会, 帐号 (A/C No) : 0200 0011 0908 9123 894 开户行 : 北京工商行安定门支行 ; U.S. Dollar Account: 户名 (in A/C with) : 唐仁林 (TANG REN LIN) 帐号 (A/C No) : 336352847102; 开户 : 中国银行北京中关村科技园区支行 Notice: Please double check the account number and contact lug@tsinghua.edu.cn after your money has been transferred, or if you have any questions about the transfer.

This application fee covers all of the events for the 6th Mission until it is achieved. Teams entering for the first time subsequent to 2010 are still liable for the application fee. (This fee has been instituted to discourage teams from applying that are not serious competitors). As an incentive, part of this application fee will be returned to those teams performing to a specified level during each event (see the Scoring section for details on fee rebate).

Upon receipt of the one-time application fee, your team will become “official” and will get listed on the official web site (this helps you to gain sponsorship grants), and co-sponsors offering special promotions will be notified that your team is eligible these offers (see offer details as they become available at: <http://iarc.angel-strike.com/>).

A brief concept outline describing the air vehicle must be submitted for safety review by the Judges (the application form provides space for this). The Judges will either confirm that the submitting team design concept is acceptable, or will suggest safety improvements that must be implemented in order to participate.

A web page showing a picture of your primary air vehicle flying either autonomously or under remote human pilot control must be posted/updated by June 1 of each year to continue to be considered as a serious entry. The web page should also include sections describing the major components of your system, a description of your entry’s features, the responsibilities of each of your team members, and recognition for your sponsors. At least one picture of your vehicle flying is required, though additional photographs of the other components comprising the system are desirable. People accessing your page should be able to learn something about your system from the pages. Web pages that are deemed adequate will be listed with a link from the official Competition web site.

A research paper describing your entry will be due by the date shown at the bottom of these pages. The paper should be submitted electronically in .pdf format via E-MAIL to millennialvision.llc@gmail.com (no hard copy is required). This paper will be presented as part of the annual Symposium to be conducted in concert with the IARC. Presentation at the Symposium is mandatory for all competing teams and is part of the Static Judging process. Teams should augment their presentations with Keynote or PowerPoint presentations. Each team paper will be posted at the Official IARC web site each year after the event.

† SEPDAC Inc. is a 501c3 tax exempt Georgia corporation established in part, to support the goals and missions of the International Aerial Robotics Competition.

Teams may be comprised of a combination of students, faculty, industrial partners, or government partners. Students may be undergraduate and/or graduate students. Interdisciplinary teams are encouraged (EE, AE, ME, etc.). Members from industry, government agencies (or universities, in the case of faculty) may participate, however full-time students must be associated with each team. The student members of a joint team must make significant contributions to the development of their entry. Only the student component of each team will be eligible for the cash awards.

Since this 6th Mission of the International Aerial Robotics Competition was announced in AD2009 and will run until the mission is completed, anyone who is enrolled in a college or university as a full-time student (as defined by their university) any time during or after the calendar year that the team first made application, is qualified to be a “student” team member.

Logistics

Each team will be given four attempts during the total time allotted for performance judging. Within these four attempts the team shall demonstrate as much as it can. The team scoring the most points during the Static Judging will be awarded one additional attempt. However, due to the fact that the competition is not schedule driven, no team will be able to choose what time of day it will be making its attempt. The Judges will announce the starting order. After an attempt has been made, the team can choose to continue and make an additional attempt (within 10 minutes) or leave the arena and reenter the performance sequence. If a team is not ready to make an attempt when in sequence, it is allowed one “free pass” but must be prepared the next time or the lose one attempt. Each team will be allotted 15 minutes to start an attempt. The team captain will declare to the Judges the start of an attempt. If in the opinion of the Judges an attempt fails due to a situation beyond the team’s control, it will not count against the team’s remaining allotment of attempts.

A specified “*Staging Area*.” will be located outside of the Competition Arena. There will be a specified “*Contestant Area*.” During the performance, the vehicle operator interface and vehicle operators, with the exception of the safety pilot, will be stationed in the *Contestant Area*. The team that is next in the Competition sequence shall begin staging their equipment in the *Staging Area*. If the next team is planning to “pass” then at least one member of the team shall be present in the *Staging Area*. Once the currently performing team has finished and vacated the *Contestant Area*, the team currently occupying the *Staging Area* shall move its equipment into the *Contestant Area*. In the special case where at the end of a performance, the next team in the queue is not present or unrepresented in the *Staging Area*, one (1) attempt will be forfeited by that team and the Judges will call for the next team in the queue to move into the *Staging Area* where they will have 10 minutes to prepare prior to moving forward into the *Contestant Area*.

Points will be used to determine team rankings and any progress awards apart from the grand prize. Judges will score each valid attempt, with the highest score being used to determine the final ranking score.

Teams may have no more than one entry, though that entry may be comprised of any number of vehicles. Only one team may be affiliated with any particular university (though different universities may band together to form a single team). If several teams wish to enter from a single university, a decision must be made by the university (not the IARC) as to which team will represent the school.

This may be done as a result of an engineering analysis of each team's design and progress, or it may be as a result of an actual demonstration of hardware. The determination should be by a panel of impartial evaluators not directly affiliated with either team. Notification (prior to the journal paper submission) of which university entry is the "official" one must be provided in writing by someone equivalent to the "Dean of Engineering" since various departments or campus may be vying for the honor of representing the university.

It is hoped that teams will join together to offer their best ideas for the benefit of a single unified team, while being willing to compromise and defer to team members with specific training and skills. The most successful teams are interdisciplinary groups of dedicated engineers and scientists with backing from their university administration and industrial partners. Having a strong, involved Faculty Advisor has proven beneficial to all winners in the past.

To discourage multiple entries from a university, each team vying to represent the university must submit its individual applications in accordance with the schedule shown at the bottom of these pages, along with a nonrefundable (see rebate policy) 1000 U.S. Dollar application fee. No application will be considered valid without the accompanying fee being received. It is therefore in the interest of all potential competitors from a single university to form their team without the need for arbitration prior to submission of an application.

Scoring

Scoring will be based on performance of particular autonomous behaviors. Only those completing the 6th Mission goal as defined above are eligible to receive the grand prize cash award. In addition to the demonstrated behaviors described below, the journal quality paper describing the team's entry (defined below) must be submitted by the designated date.

Rebate Incentive: Teams which have vehicles that are able to autonomously complete the entire 6th Mission in their first attendance at the IARC will receive their entire application fee refunded in full (in addition to prize money award).

The first team to execute the full mission will win the AUVSI Foundation prize money and be declared the winner of the entire competition if no other teams are able to perform equally in a given year. During a particular year, if more than one team is able to achieve mission success, then the team that is able to execute the full mission with the highest aggregate score will be declared the winner. In the event that multiple teams execute the full mission with the same aggregate score, the team performing in the least amount of time (± 1 minute) will be deemed the winner.

A team's score will be based on a number of factors as follows:

Effectiveness Measures:

Points allotted for the following:

1. Avoiding all obstacles without collision **(A)** (+200 points)
2. Retrieving the flash drive **(B)** (+1000 points).
3. Dropping off the decoy flash drive **(C)** (+500 points).
4. Conduct of a completely covert mission **(D)** (+500 points).
5. Except for launch and recovery, fully autonomous operation **(z)** is required (+1), else (0).
6. Mission failure without successful self destruction **(x)** (+1 for success), else (0.5 for failure).

Subjective Measures:

1. Elegance of design and craftsmanship (E) (up to +75 points).

1.1 Component integration (0 to +25).

1.2 Craftsmanship (0 to +25).

1.3 Durability (0 to +25).

2. Innovation in air vehicle/subvehicle design (F) (up to +150 points).

2.1 Primary propulsion mechanisms (0 to +30).

2.2 Attitude/heading adjustment schemes (0 to +30).

2.3 Navigation techniques (0 to +30).

2.4 Target identification techniques (0 to +30).

2.5 Threat avoidance schemes (0 to +30).

3. Safety of design to bystanders (G) (up to +200 points).

3.1 Isolation/shielding of propulsors (0 to +75).

3.2 Energy source stability/safety (0 to +25).

3.3 Crashworthiness (0 to +25).

3.4 Emergency termination mechanisms (0 to +75).

4. Journal Paper. Each team is required to submit a journal-quality paper (written in English) documenting its project. This paper (**H**) is worth between -100 and +100 points depending on technical quality (0 points minimum for submitting a credible paper, and -100 points for those not submitting a paper by the deadline). Papers are limited to 12 pages (including figures and references, if any). The format shall be single-sided with text occupying a space no greater than 9 inches tall by 6.5 inches wide centered on each page. Font size shall be 12 point (serif font) with 14 point leading. The example format is provided as an addendum to the rules (see <http://iarc.angel-strike.com/paperformat.pdf>). Topics to be covered are detailed in a printable document found at <http://iarc.angel-strike.com/papercontent.pdf>. A file in .pdf format of your paper is due via E-MAIL to millennialvision.llc@gmail.com by June 1 of each qualifier year. All papers will become part of the IARC Symposium proceedings for that year and will therefore serve as a publication reference on team member resumé's.

5. Best team Tee Shirt (I) (10 points to the best, 5 points to others having team Tee Shirts, and 0 points to those not having team Tee Shirts).

In addition to the points scored during the Static Judging (Subjective Measures), the teams will be rank-ordered by the judges based on score.

Scores for a given round will be totaled according to the following formula:

$$\text{SCORE} = x (A + B + C + D + E + F + G + H + I) z$$

The highest score accumulated by a given entry after all runs have been completed in any event year will be considered that team's current ranking for that year.

“Air Vehicle” Definition and Attributes

1. “Air Vehicles” are considered to be those capable of sustained flight out of ground effect while requiring the earth’s atmosphere as a medium of interaction to achieve lift (as such, pogo sticks and similar momentary ground-contact vehicles are not considered to be flying air vehicles). The scoring formula and arena have been carefully designed to normalize advantages inherent to a given class of air vehicles such that all may compete fairly to perform the same tasks. Prospective teams must decide how best to allocate resources to maximize their potential score in light of the constraints imposed by the arena, the task, and the scoring algorithm.
2. Air vehicles may only land and takeoff within the arena while fully autonomous except when over ridden by the safety pilot (which terminates the attempt). Initial launch must be autonomous and without human assistance other than to issue the launch command via a switch, voice control, or other electronic interface. Vehicles crossing no-fly boundaries, or which seem to be going away from a logical path leading to the target zone, will be brought back under safety pilot control or terminated by the Judges.
3. Each air vehicle must be equipped with an independently-controlled, non-pyrotechnic termination mechanism that can render the vehicle ballistic upon command of the Judges. This termination mechanism must be demonstrated to the Judges prior to each round of each event. Air vehicles may land under manual control of a safety pilot in the event of an emergency, but credit for that run will be forfeited unless manual control is exercised AFTER the mission has been completed in full. Both autonomous and manually-assisted landings must occur within the boundaries of the Competition arena or staging area.

Judging

A team of three judges will determine compliance with all rules. Official times and measures will be determined by the Judges. Subjective measures (1-5) will be Static Judged in accordance with a schedule to be announced during the competition week. Team papers will have been reviewed by the Judges in advance of this Static Judging.

Prize Awards

The following benefits accrue to the teams participating in, and winning the International Aerial Robotics Competition:

1. Ten thousand dollars will be added to the prize each year. In the unlikely event that the full mission is achieved in the first event year (2010), a US\$10,000 prize would be awarded. If for example, the full mission were not achieved after the fourth event year (2013), a US\$40,000 cash prize would be awarded to the winner of the Competition.
2. Any other awards prior to the completion of the full mission, shall be distributed at the discretion of the Judges.
3. International recognition for the winning students’ university.
4. International recognition through AUVSI for the winning industrial/government/faculty organization.
5. Free full-page advertisement for the winning company, governmental agency, or university faculty department in Unmanned Systems magazine.

2013 Schedule

American Asia/Pacific

REMEMBER THESE IMPORTANT DATES:

Notification of intention to compete	ASAP	ASAP
2013 Application Deadline (new teams only)	May 1	May 1
Attendee List due	May 15	May 15
Current Team web page on line	June 1	June 1
Journal quality paper (all teams)	June 1	June 1
*Having flown the 6th Mission at home twice	June 1	June 1
(*Recommended strongly)		
Teams can arrive on site (earliest 10 AM)	August 5	July 31
Team Registration (10 AM - Noon)	August 5	July 31
Static Judging (by appointment announced at Registration)	August 6	Aug 1
2013 Symposium on Indoor Flight Issues	August 6	Aug 1
Performance Judging (visitors welcome)	August 7	Aug 2
Performance Judging/morning if needed (visitors welcome)	August 8	Aug 3
Arena take-down	August 8	Aug 3
Awards Banquet	August 8	Aug 4

NOTE: "Practice times" for teams to align their systems near or in the Arena, will be on 1 August (but not during the Symposium hours, so don't ask).

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