

CIMA Meeting 2007

Proposed Tasks

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Task A. Curve Navigation with Time Estimation

Precisely fly the course defined by an arbitrary line drawn on the map, with time estimations and a time limit.

Description

Pilots will receive a course drawn on a map. There will also be a number of **known time gates** where pilots will estimate their crossing time, counted from the start point.

Before take-off, pilots will hand their declarations to a marshal.

They will take off from their designated deck and fly to the start point, where time will start. Then they will precisely fly the course trying to cross the time gates in order at their estimated times.

Navigation and timing end at the finish point.

There will be an undetermined number of **hidden gates** to validate the course. Gates must be crossed in order and proper direction. Crossing the same gate more than once in any direction invalidates the gate. Example: The sequence 1-2-4-3-5-6-5-7 will be evaluated as 1-2-4-6-7, a total of five correct gates.

Time will be measured at the known time gates and checked against pilot declarations. If a time gate is crossed more than once, time will be extracted from the first crossing.

There will be a maximum flight time – T_{max} – between crossing the start and finish points. No pilot may declare an estimated time beyond this limit.

SP	→	HG	→	TG1	→	HG	→	...	→	TG2	→	HG	→	...	→	FP
T = 0	Nav	+1	Nav	T1	Nav	+1	Nav		Nav	T2	Nav	+1	Nav		Nav	T < T _{max}

Scoring

Spatial precision

N_h = Number of hidden gates in the task

H = Number of hidden gates correctly crossed (crossed once, in order and proper direction)

Q_h = $1000 \times H / N_h$

Time precision

N_t = Number of time gates.

E_{max} = Maximum error (in seconds) in each time gate (typically 180).

E_t = Sum of absolute errors in time gates.
Maximum error of E_{max} seconds in each point.
 E_{max} seconds error is applied if point not flown.

Q_t = $E_{max} * N_t - E_t$

Total

Q = $Q_h - Q_t$

P = $1000 \times Q / Q_{max}$

Comments

An additional penalty may be established for an excessive delay to cross SP since take-off.

An additional penalty may be established for an excessive delay to cross FP since crossing SP.

The task can also be run without the time precision part (no known time gates). Then Q_t is dropped from the scoring formula.

Task B. Precision Navigation

Fly a circuit at a constant speed in each straight leg, estimating arrival times to known turn points.

Description

A circuit will be defined by a start and finish points, with a number of intermediate turn points. All points will be known before take-off.

Before take-off, competitors will hand a declaration of their estimated times of arrival to every turn point in the circuit, including the finish point.

Competitors will take-off from their designated decks and fly to the START point where navigation and timing start. They will fly each leg at a constant speed that should be consistent with their declarations. The speed in each leg may be different, but it must be constant along the leg.

There will be hidden time gates along the corridors.

Navigation and timing end at the FINISH point. Then they will proceed to land at their designated decks.

START	→	AA	→	BB	→	CC	→	DD	→	FINISH
T = 0	Nav	Ta	Nav	Tb	Nav	Tc	Nav	Td	Nav	Te

Scoring

Each hidden gate crossed scores 180 points. A gate crossed twice or crossed in the opposite direction will be invalidated.

An estimated time for crossing each gate will be calculated by the organization. Crossing time will be checked against this estimation. Each second of error will score one negative point. If a gate is crossed twice, time will be extracted from the first crossing.

Spatial precision:

E_{max} = Maximum error (in seconds) in each time gate (typically 180).

N_g = Number of gates correctly crossed

Q_p = $E_{max} * N_p$

Time precision:

E_i = Absolute error in seconds in gate i .
Maximum error is E_{max} . Time gates not crossed score E_{max} seconds error.

Q_t = $\sum E_i$ (sum of errors in all time gates)

Total:

Q = $Q_p - Q_t$

P = $1000 * Q / Q_{max}$

Penalties

An additional penalty may be established for a delayed crossing of SP from the take-off time.

Task C. Contract Navigation with Time Controls

Fly a course between a combination of declared turn points, flying over some of them at a specified time.

Description

Pilots will receive a catalogue of turn points. Three of them, the start point SP, a middle point MP and the finish point FP, are mandatory and will be crossed at designated times.

Before take-off, pilots will declare the sequence of turn points they will fly.

They will take off and fly to the START point where navigation begins. Then they will fly the sequence of declared points in order, including the mandatory MIDDLE POINT and FINISH POINT. This two points will be flown at the specified time. Upon reaching the finish point, navigation ends.

Turn points may only be visited once.

Time starts counting at the start point (SP). Competitors will fly over the middle point (MP) exactly T seconds after SP and will fly over the finish point (FP) exactly 2T seconds after SP.

Pilot's declaration will include MP. Points declared to be flown after MP can't be flown before the established time for MP. Otherwise those points will be invalid.

SP	→	P1	→	...	→	MP	→	Pn	→	...	→	FP
Time = 0 s	Nav		Nav		Nav	Time = T s	Nav		Nav		Nav	Time = 2T s

Scoring

Turn-points

- N = Number of turn-points declared and flown in order (different from SP, MP and FP).
- Ep = Number of declared points that were not flown (or not in order), including SP, MP and FP.
- V = N – Ep
- Qp = 1000 * (V / Vmax)

Time estimation:

- E_{max} = Maximum error (in seconds) in each time gate (typically 180).
- E_t = Sum of absolute errors in SP, MP and FP.
Maximum error of E_{max} seconds in each point.
E_{max} seconds error is applied if point not flown.
- Q_t = E_{max} * 3 – E_t

Total:

- Q = Qp + Qt
- P = 1000 * Q / Qmax

Comments

An additional penalty may be established for a delayed crossing of SP from the take-off time.

Task D. Navigation over a known circuit

Follow a known circuit, finding markers or identifying ground features from photographs and locating their positions on a map **or crossing hidden gates**.

It may be required to distinguish between on-track and off-track markers and ground features.

There may be timing gates to take times if part of the task must be evaluated for time precision or for speed.

The task may finish with an outlanding.

Summary

Competitors will be given:

- A series of headings to follow or lines drawn on a map or a description of the procedure to draw them.
- The location of a start point (SP) before which no markers, ground features or gates will be found
- The time at which they must overfly the start point
- The location of a finish point (FP) after which no markers or ground features will be found
- Photos of any ground features **or description of canvas markers** to be identified.

If the task is to contain a speed prediction element before takeoff the competitor must either:

- Declare the ground speed at which he plans to fly, or
- Select a ground speed from those specified at the briefing, or
- **Declare crossing times at certain turn points.**

The task will normally start and finish with a Deck Takeoff and Deck Landing and after completing the landing the competitor will be required to enter a Quarantine area for scoring.

Safety

During the task competitors must not back track along the track line against the direction of the task. If there is a need to backtrack competitors must leave the track line and fly back well clear of it before rejoining the track line at an earlier point.

Scoring

Spatial precision:

Vh = Value assigned to crossing a hidden gate or properly placing a mark on the map (e.g. 100)

Nh = Number of hidden gates correctly crossed or properly placed marks on the map (less than 2 mm error).
Markers placed between 2 and 5 mm error score ½ point.
More than 5 mm score zero. Out of track marks score zero.

Qh = Vh * Nh

Time precision (when included in the task):

Vt = Gate value (e.g. 180)

Ei = Absolute error in seconds in gate i.
Maximum error is Vt.
Time gates not crossed do not add error.

Qt = $\sum (Vt - Ei)$ (sum of gate value minus time error each gate crossed)

Speed (when included in the task):

V_s = Relative value for the speed term

S = Pilot's speed in the speed section

Q_v = $V_s * S / S_{max}$

Total:

Q = $Q_h - Q_t + Q_v$

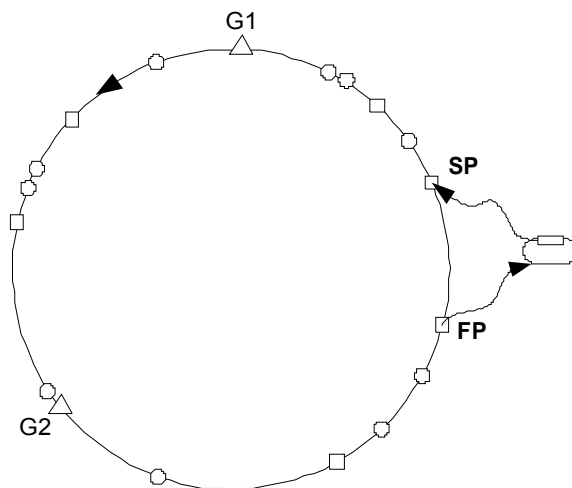
P = $1000 * Q / Q_{max}$

Penalties

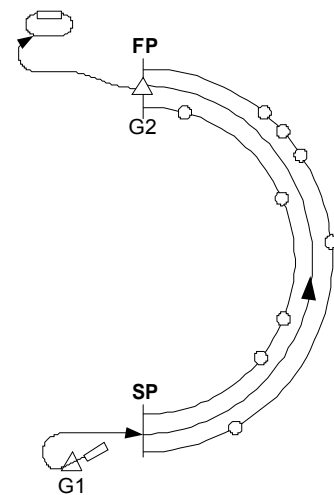
Each photo or marker correctly identified and located on the map to within 2mm and any ground speed element will score as briefed. The following penalties will apply:

- Takeoff deck penalty: 20%
- Landing deck penalty: 20%
- Backtracking against the task direction or **crossing a hidden gate backwards**: 100%
- Breach of Quarantine: 100%
- Crossing a hidden gate twice invalidates the gate.

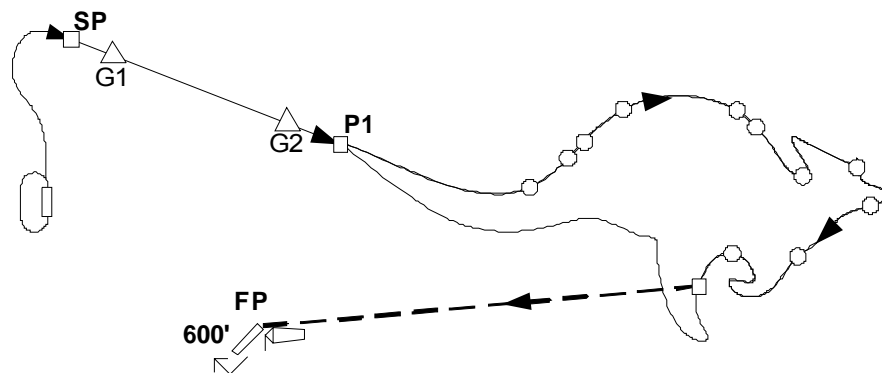
Examples



Circular navigation



Rainbow



Irregular polygon with a speed leg

Task E. Navigation with unknown legs

Follow a series of headings or known lines, finding markers and identifying ground features from photographs, and locating their positions on a map or **crossing hidden gates**.

It may be required to distinguish between on-track and off-track markers and ground features.

Certain of the ground features or markers will indicate a change of heading or the start of a leg to another point.

There may be timing gates to take times if part of the task must be evaluated for time precision or for speed.

The task may finish with an outlanding.

Summary

Competitors will be given:

- A series of headings to follow or lines drawn on a map or a description of the procedure to draw them.
- The location of a start point (SP) before which no markers, ground features or gates will be found
- Details of which markers or ground features indicate a point from which a new line must be drawn
- The location of a finish point (FP) after which no markers or ground features will be found

Depending on the specific task design, competitors may be given:

- Sealed instructions giving the location of next turn points or outlanding sites.
- The time at which they must overfly the start point
- Photos of any ground features **or description of canvas markers** to be identified.

If the task is to contain a speed prediction element before takeoff the competitor must either:

- Declare the ground speed at which he plans to fly, or;
- Select a ground speed from those specified at the briefing
- **Declare crossing times at certain turn points.**

The task will normally start and finish with a Deck Takeoff and Deck Landing and after completing the landing the competitor will be required to enter a Quarantine area for scoring.

Safety

During the task competitors must not back track along the track line against the direction of the task. If there is a need to backtrack competitors must leave the track line and fly back well clear of it before rejoining the track line at an earlier point.

Scoring

Spatial precision:

- Vh = Value assigned to crossing a hidden gate or properly placing a mark on the map (e.g. 100)
- Nh = Number of hidden gates correctly crossed or properly placed marks on the map (less than 2 mm error).
Markers placed between 2 and 5 mm error score ½ point.
More than 5 mm score zero. Out of track marks score zero.
- Qh = Vh * Nh

Time precision (when included in the task):

V_t = Gate value (e.g. 180)

E_i = Absolute error in seconds in gate i .
Maximum error is V_t .
Time gates not crossed do not add error.

Q_t = $\sum (V_t - E_i)$ (sum of gate value minus time error each gate crossed)

Speed (when included in the task):

V_s = Relative value for the speed term

S = Pilot's speed in the speed section

Q_v = $V_s * S / S_{max}$

Total:

Q = $Q_h - Q_t + Q_v$

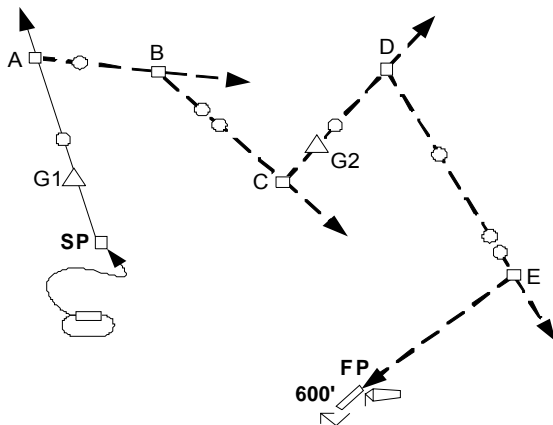
P = $1000 * Q / Q_{max}$

Penalties

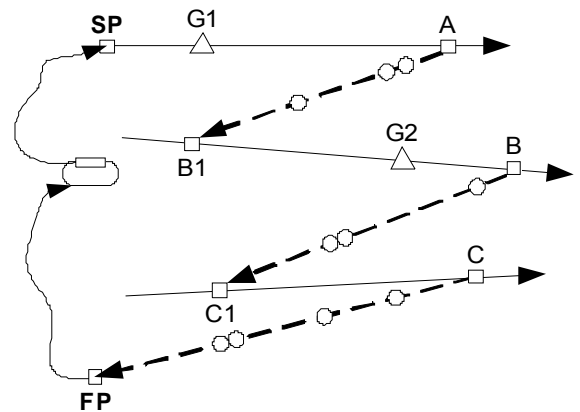
Each photo or marker correctly identified and located on the map to within 2mm and any ground speed element will score as briefed. The following penalties will apply:

- Take-off deck penalty: 20%
- Landing deck penalty: 20%
- Backtracking against the task direction or **crossing a hidden gate backwards**: 100%
- Breach of quarantine: 100%
- Crossing a hidden gate twice invalidates the gate.
- A penalty will be specified for braking an envelope seal.

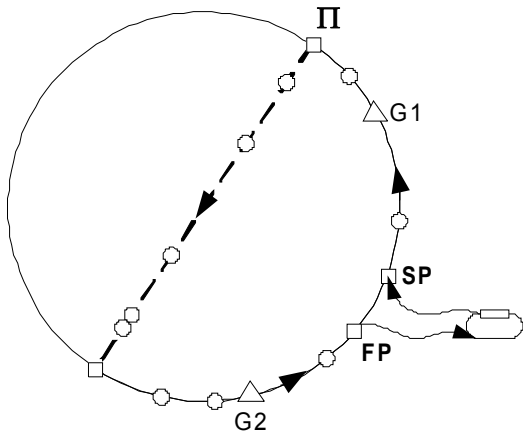
Examples



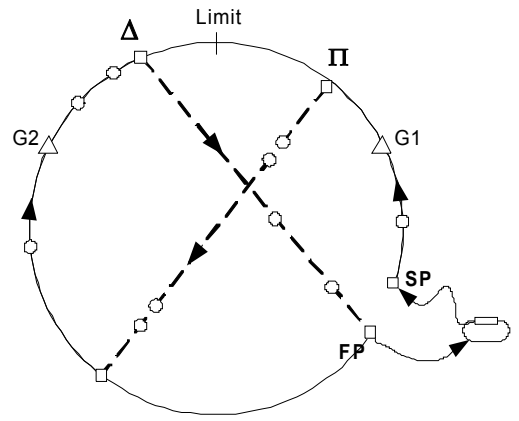
Sequential navigation



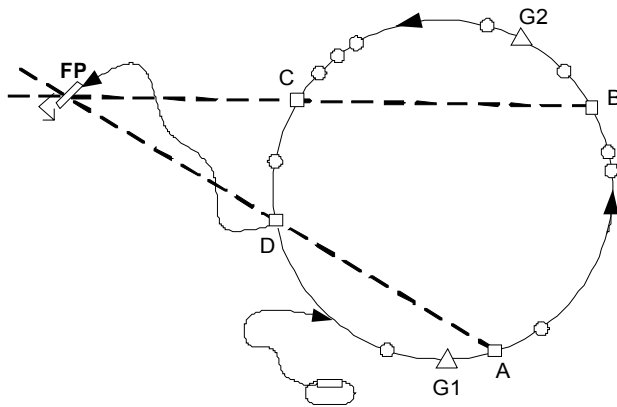
Linear navigation



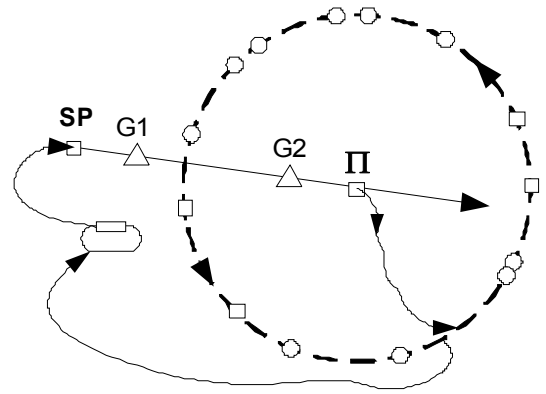
Circular navigation and diameter



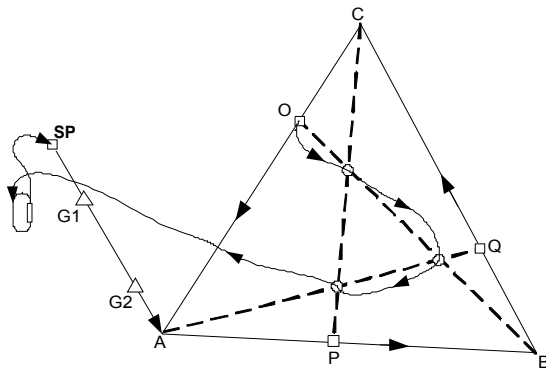
Circular navigation, diameter and reverse



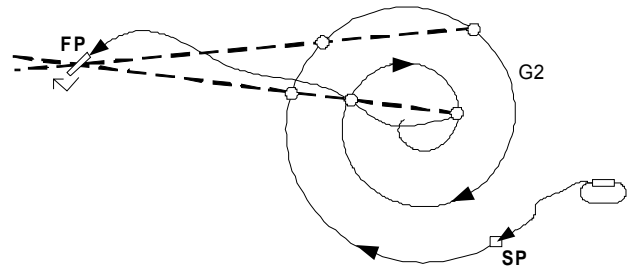
Circle and two lines



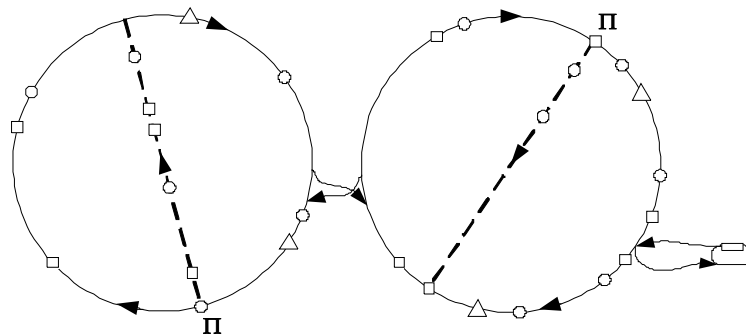
Drawn circular navigation



Triangle and three lines



Speed spiral and two lines



Double circular navigation

