FAI Badges

Some things you should know (before your badge flights)

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www.darrylramm.com

Outline

- Introduction to badges and rules
- Observation zones
- IGC flight recorders
- Declarations
- 1% rule
- Altitude
- Duration
- Misc problems

Rule Makers and Administrators

- FAI – Fédération Aéronautique Internationale
- IGC – International Gliding Commission
- SSA – Soaring Society of America
  - Administers FAI badges within the USA
  - Judy Ruprecht “Badge Lady”

Badge Rules and Resources

- FAI Sporting Code Section 3 (“SC3”)
  - www.fai.org/gliding/sporting_code
- FAI Sporting Code Section 3 Annex C (“SC3C”)
  - Official Observer & Pilot Guide
- IGC Flight recorders
  - www.fai.org/gliding/gnss
  - Approval document for your flight recorder
  - Download and validation software
  - Technical specifications for IGC flight recorders
- SSA badge forms, guides and FAQ
  - www.ssa.org > Soaring Achievement > Badges

FAI Badges

Silver Badge (SC3 2.2.1)

- Distance: 50km straight flight or leg of pre-declared course
- Duration: 5 hours duration flight
- Height: 1,000m height gain

Gold Badge (SC3 2.2.2)

- Distance: 300km distance flight
- Duration: 5 hours duration flight
- Height: 3,000m height gain

Diamonds (SC3 2.2.3)

- Distance: 500km distance flight
- Goal: 300km goal flight, out-and-return or triangle
- Height: 5,000m height gain

FAI Badge Notes

- In a glider by yourself with no external help
- Can claim soaring performances for any badge on any flight
  - No prescribed order or prerequisites
- Same flight can be used for multiple badges
  - e.g. a 500km out and return could qualify for silver distance, gold distance, diamond distance, diamond goal, gold and silver altitude
- Rules try to favor the the pilot
  - Hard to understand
  - Certain aspects expected to be precise

Sporting Code (SC3) Caution

- Read front to back
  - i.e. Bottoms up from definitions
- Then read top down starting with badge, course type, definitions of start finish etc.
  - Higher level things will preclude parts of lower level definitions
- *Always* read top down not bottoms up when checking requirements

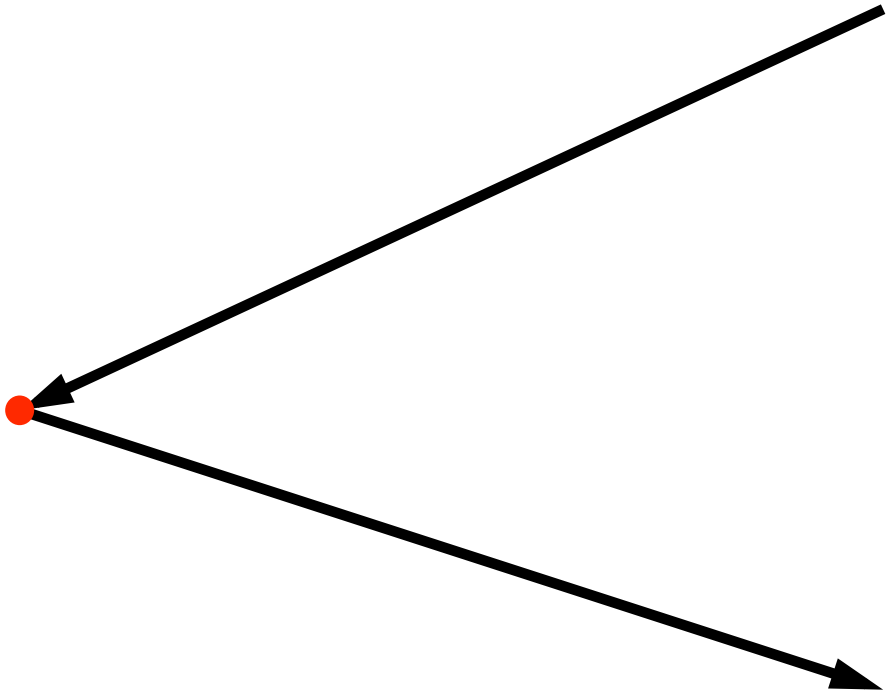
Observation Zones

Observation Zones

- Waypoint is just a point/coordinate
  - Start point
  - Finish point
  - Turn point
- Corresponding Observation Zone (OZ)
  - Sector
  - Cylinder (IGC flight recorder only)
- Start and/or finish may also be a line
- Start can be off-tow/end MoP
- Finish can be landing or start MoP*

* Not always – motor glider pilots be careful

Turnpoint

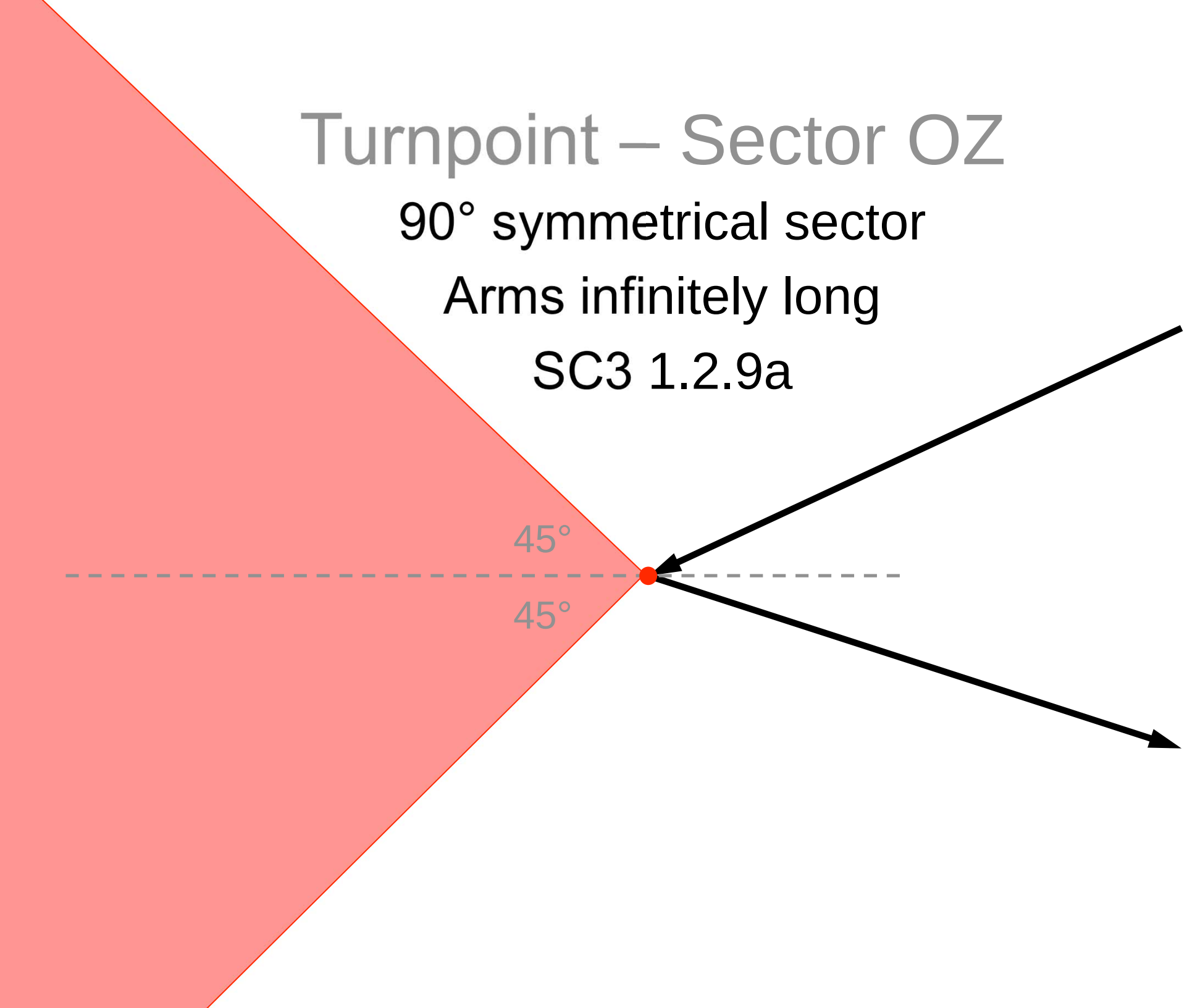


Turnpoint – Sector OZ

90° symmetrical sector

Arms infinitely long

SC3 1.2.9a

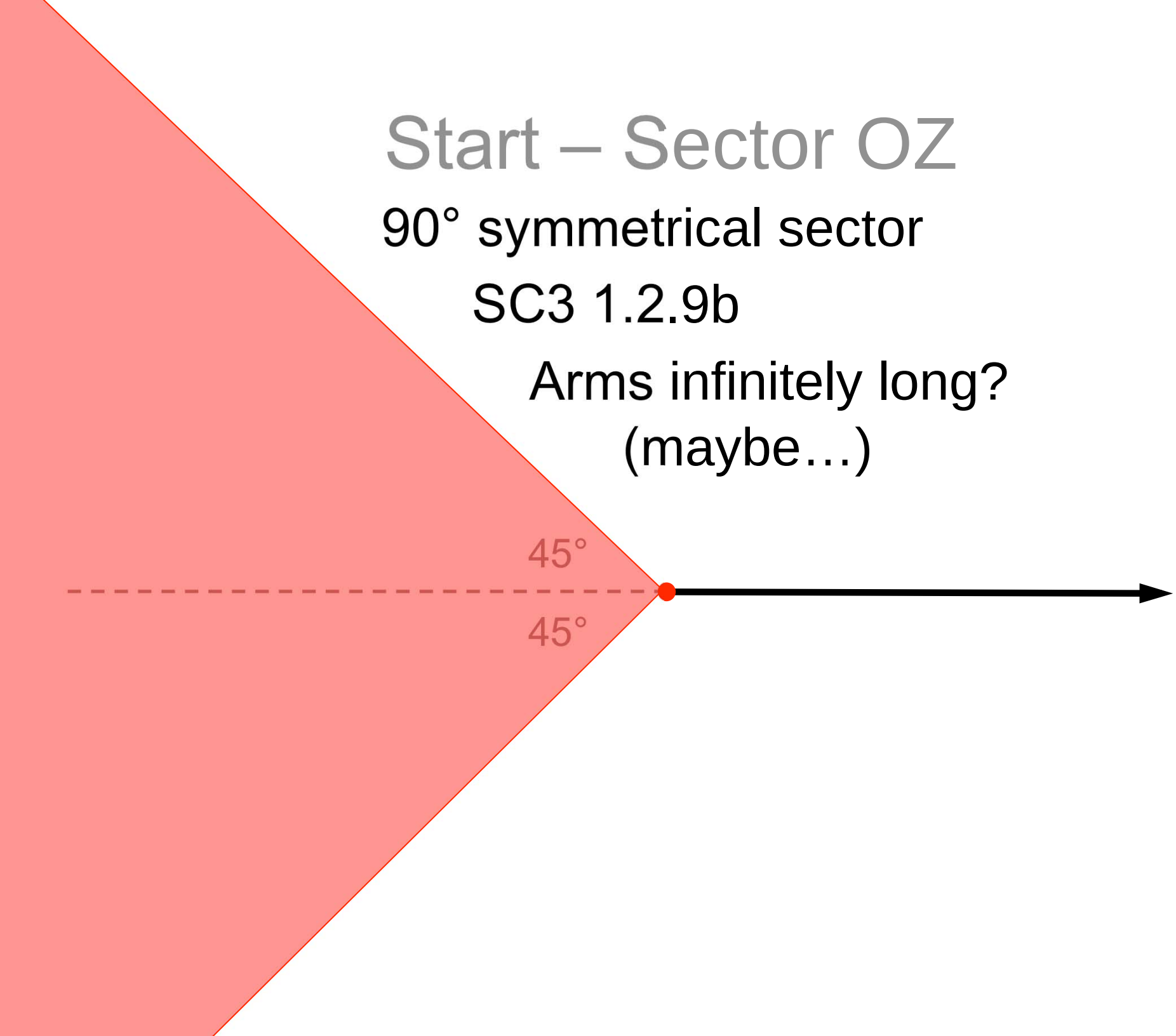


Start – Sector OZ

90° symmetrical sector

SC3 1.2.9b

Arms infinitely long?
(maybe…)

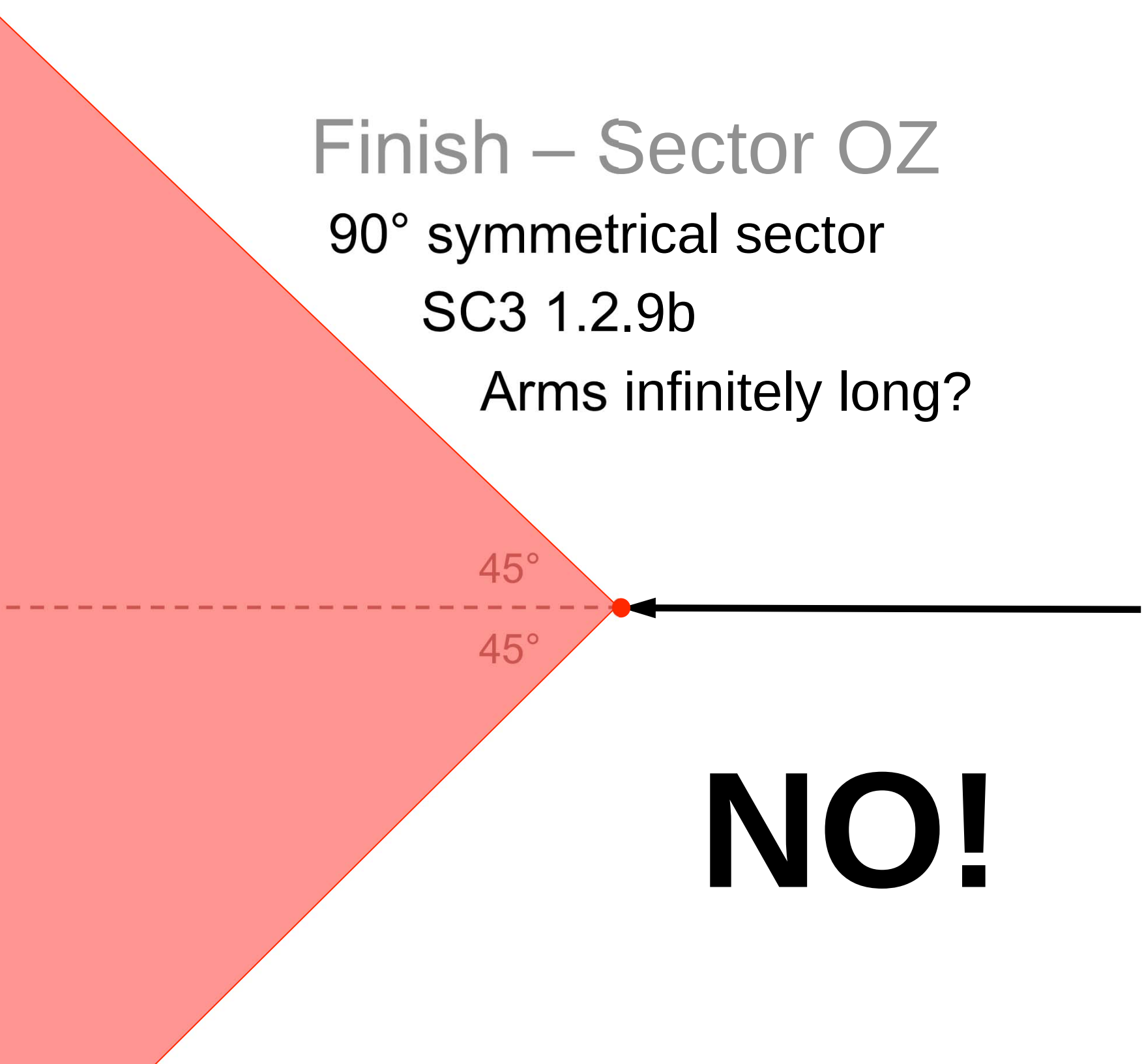


Finish – Sector OZ

90° symmetrical sector

SC3 1.2.9b

Arms infinitely long?

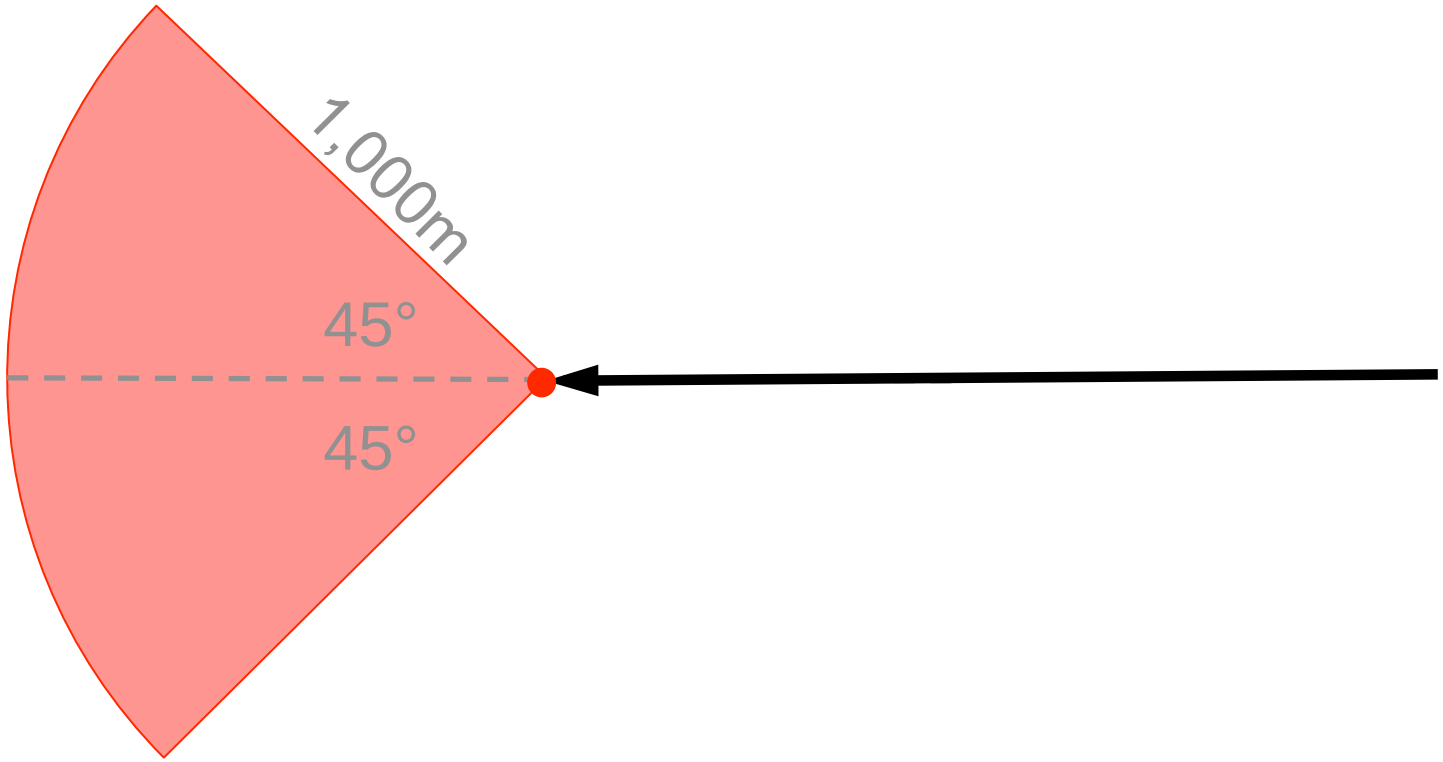


NO!

Finish – Sector OZ

Declared finish arms 1,000m

SC3 4.3.3



SC3 4.3.3 Achieving the Goal

Where the soaring performance is required to end at a declared finish point, the goal will be achieved if:

a. The landing point is within 1000 metres of the declared finish point or,

b. If the finish point is an airfield, the landing is within the boundaries of the airfield or,

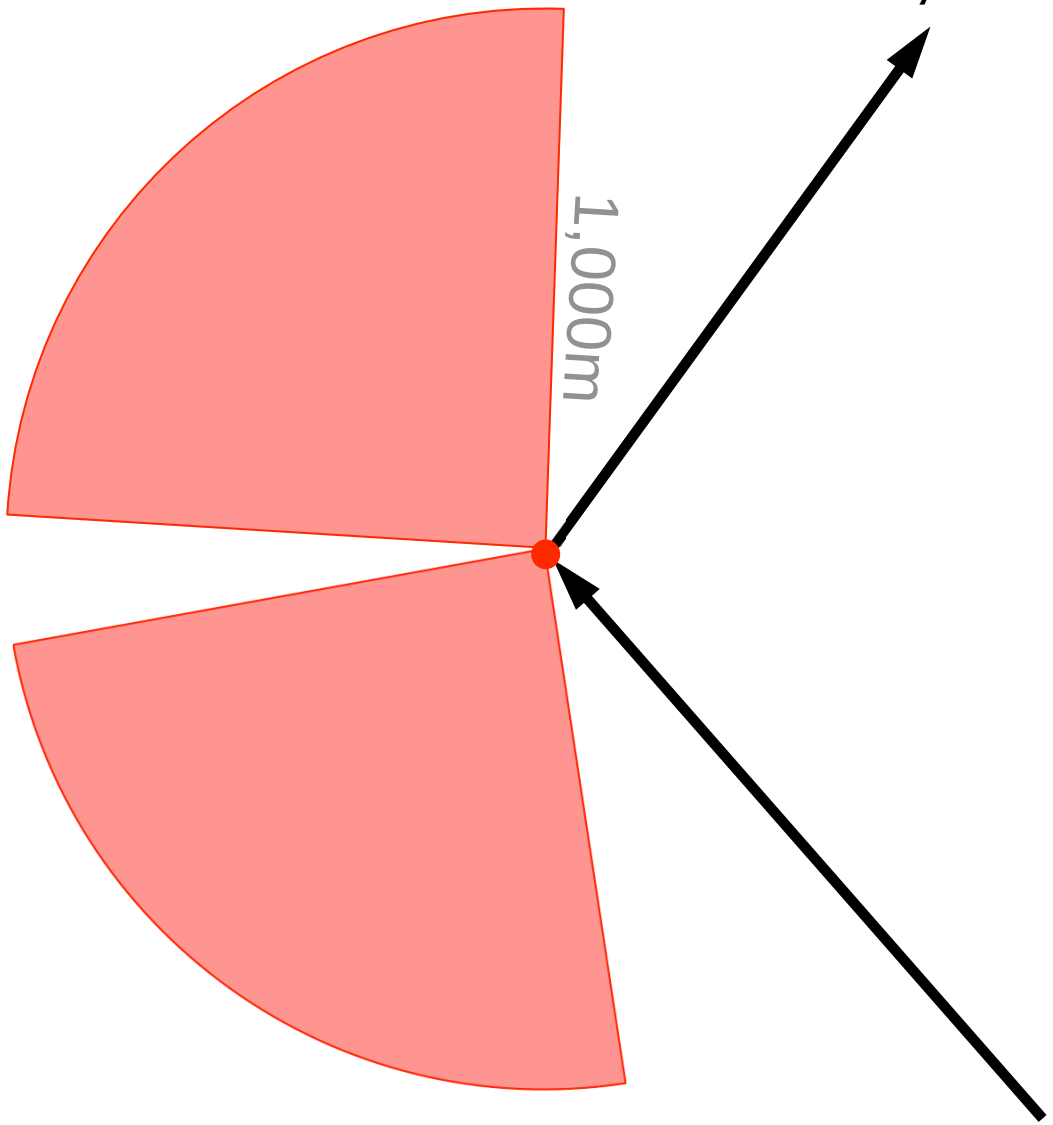
c. Satisfactory evidence is produced showing that the glider was in the observation zone and within 1000 metres of the finish point, or

d. A finish line at the goal is crossed.

e. For any type of closed course goal flight where a start other than release or a start line is used, the glider must exit the start point OZ within 1000 metres of the declared start point.

Closed Course

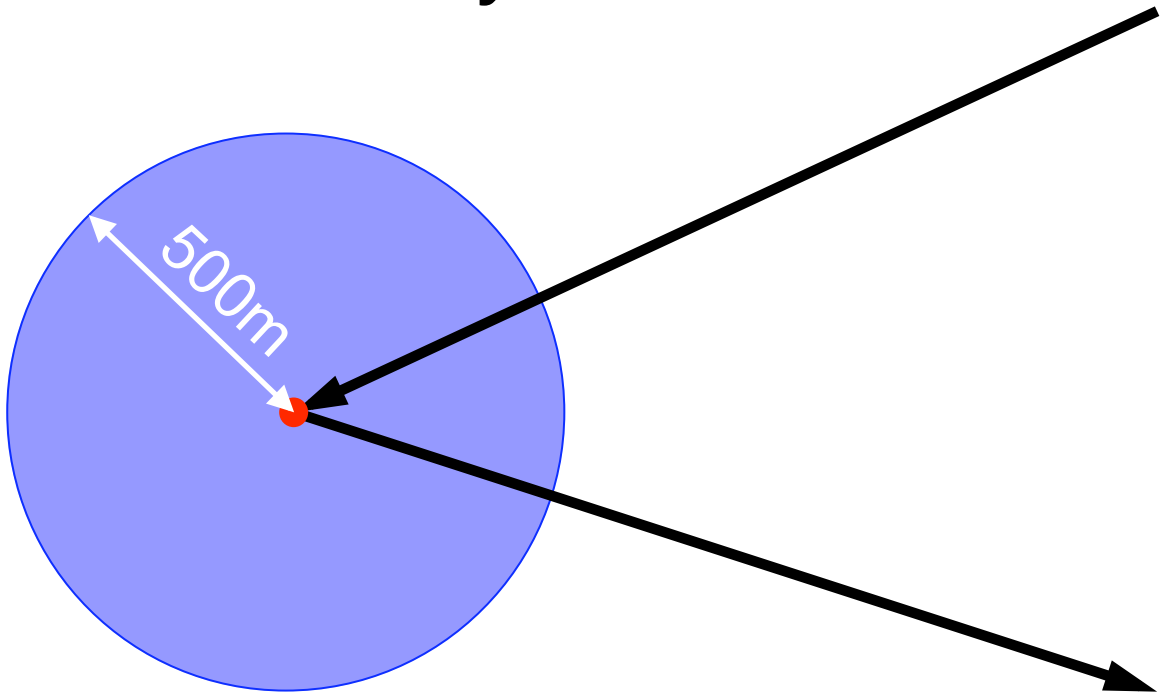
Both start and finish OZ have 1,000m arms



Turnpoint – Cylinder OZ

500m radius SC3 1.2.10

IGC flight recorder only SC3 1.1.5

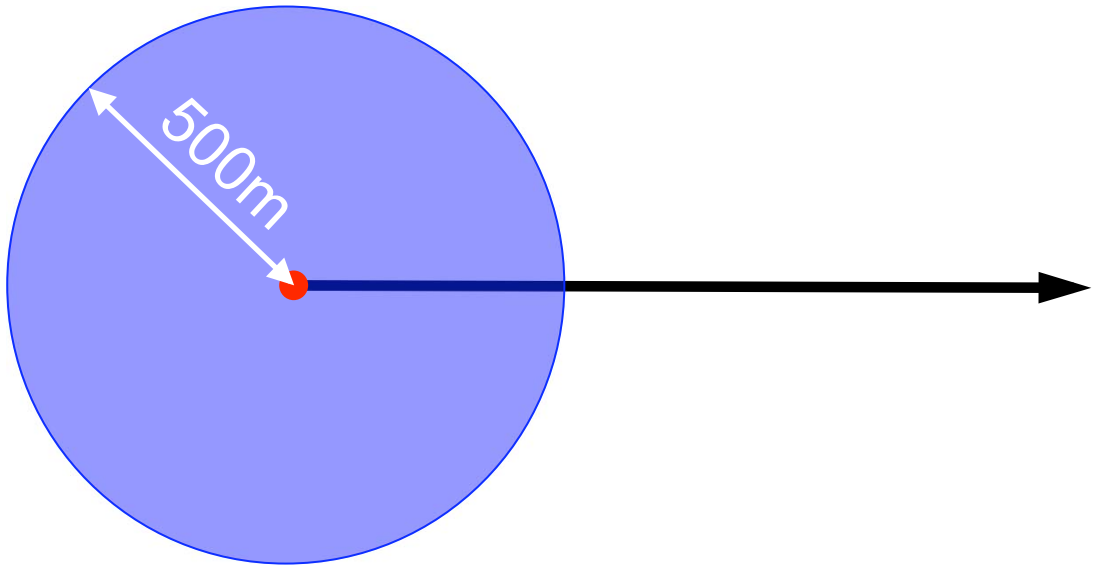


Leg length reduced by 500m each time it crosses a cylinder boundary SC3 1.2.11

Start – Cylinder OZ

500m radius SC3 1.2.10

IGC flight recorder only SC3 1.1.5

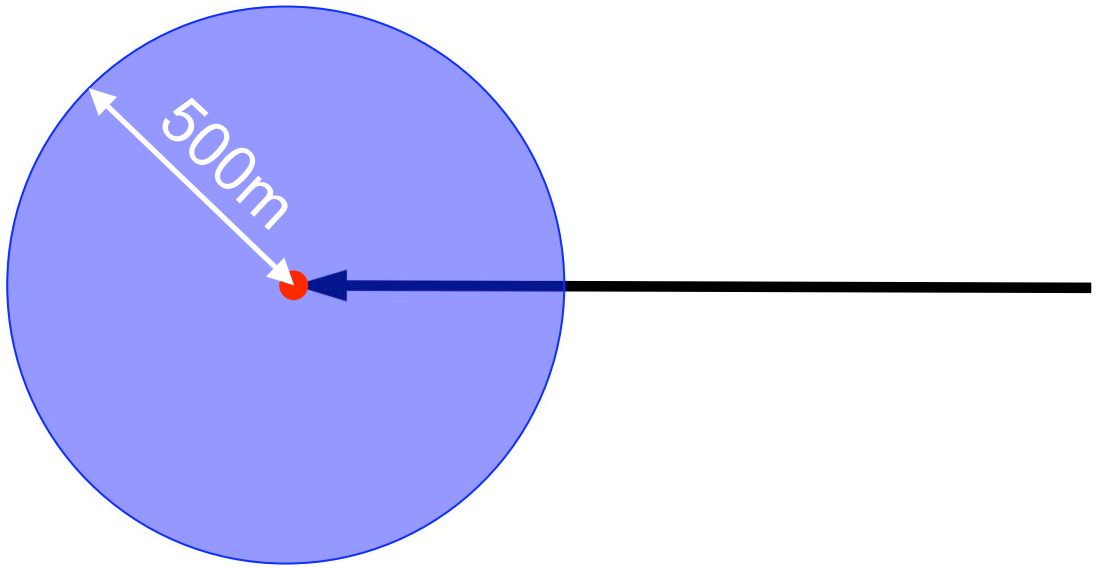


Leg length reduced by 500m each time it crosses a cylinder boundary SC3 1.2.11

Finish – Cylinder OZ

500m radius SC3 1.2.10

IGC flight recorder only SC3 1.1.5

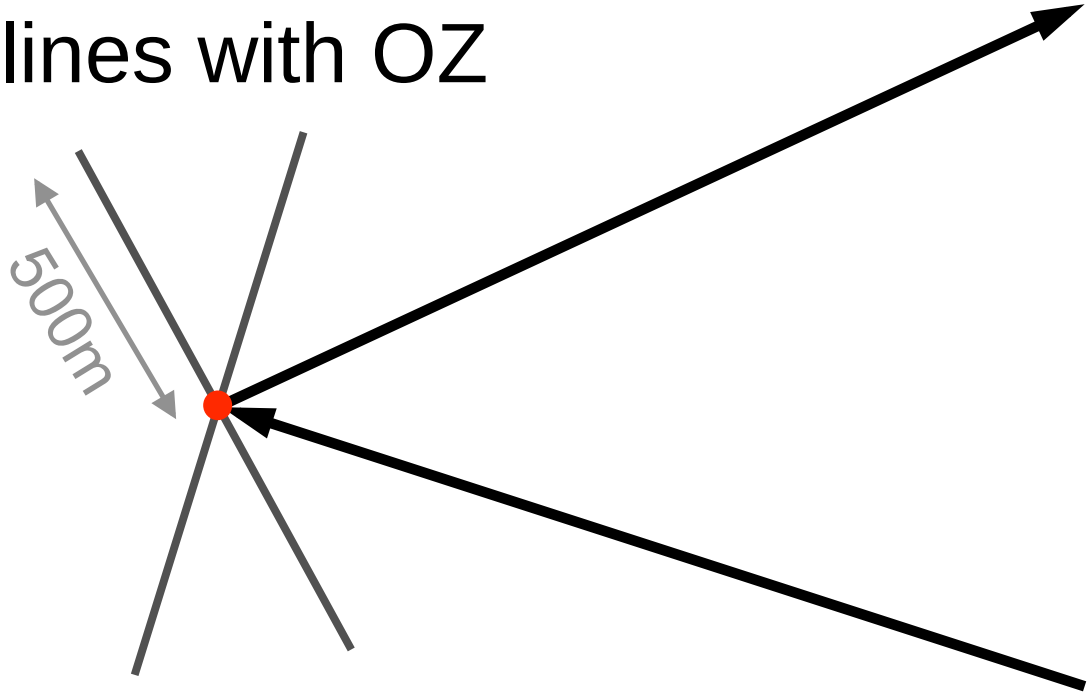


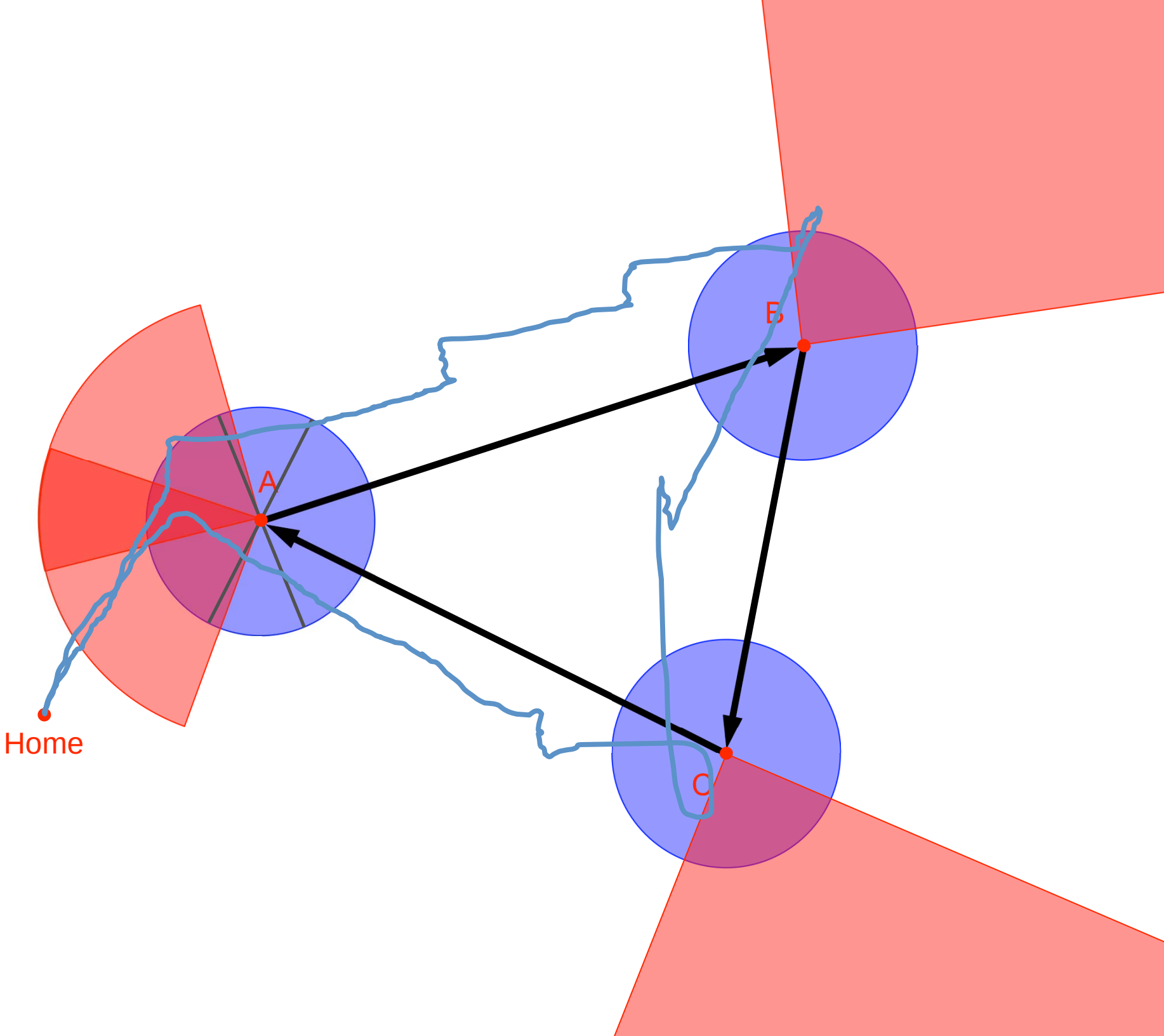
Leg length reduced by 500m each time it crosses a cylinder boundary SC3 1.2.11

Start and Finish Lines

1,000m length SC3 1.1.9 and 1.1.13

Can mix and match start and/or finish lines with OZ



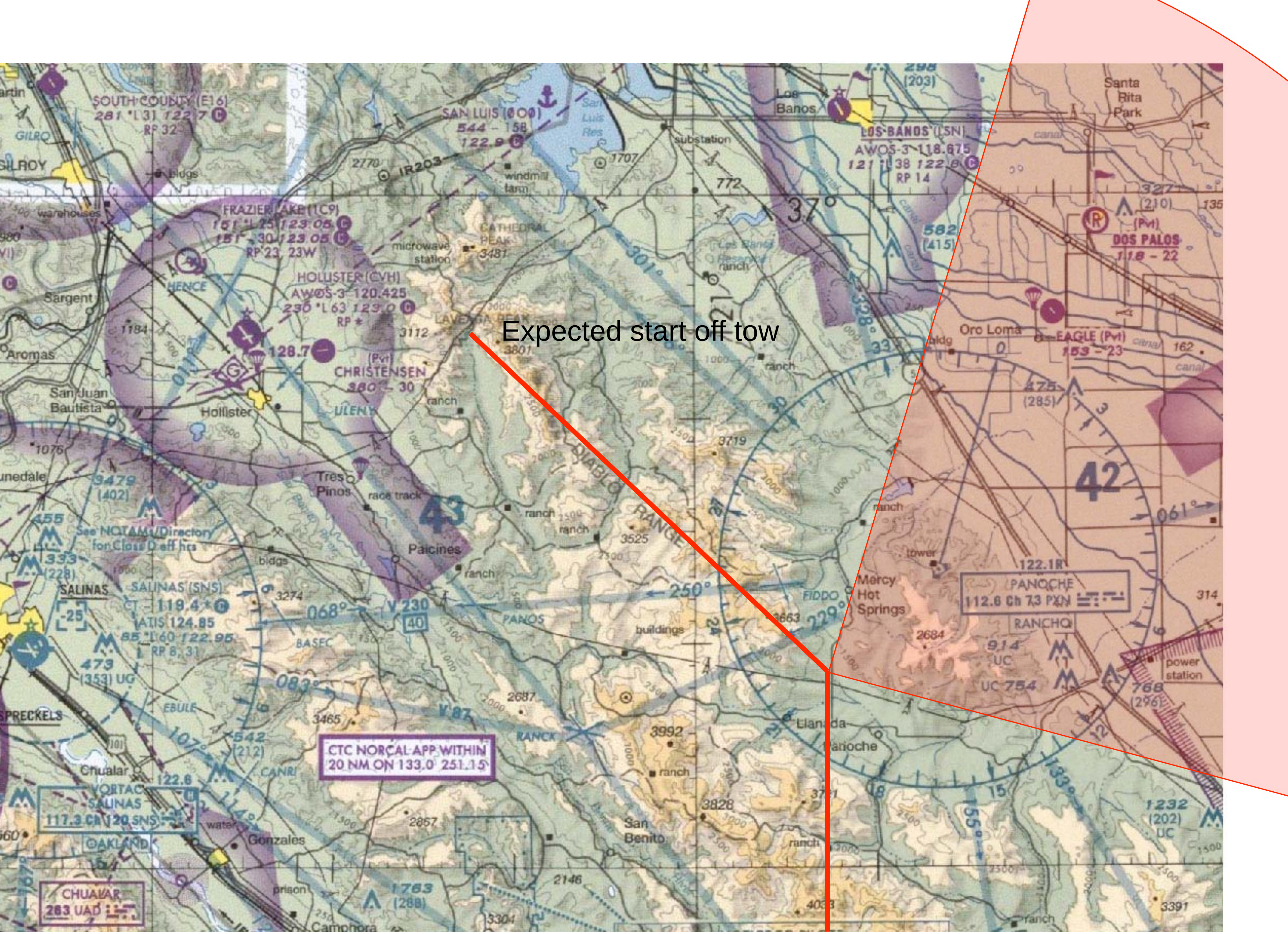

A
B
C
Home

Observation Zones

- OZ type is not in the flight declaration
- Can use either sectors or cylinder OZ in one flight (SC3 1.1.5)
  - e.g. cannot use start cylinder with turnpoint sectors
- Can use start or finish line with any
- You get to decide (after the flight!)
- If needed Judy will try all valid permutations
- Try to leave yourself maximum flexibility
- Set flight recorder to log < 10 sec (<4 better)
- Do not rush, enter the OZ properly

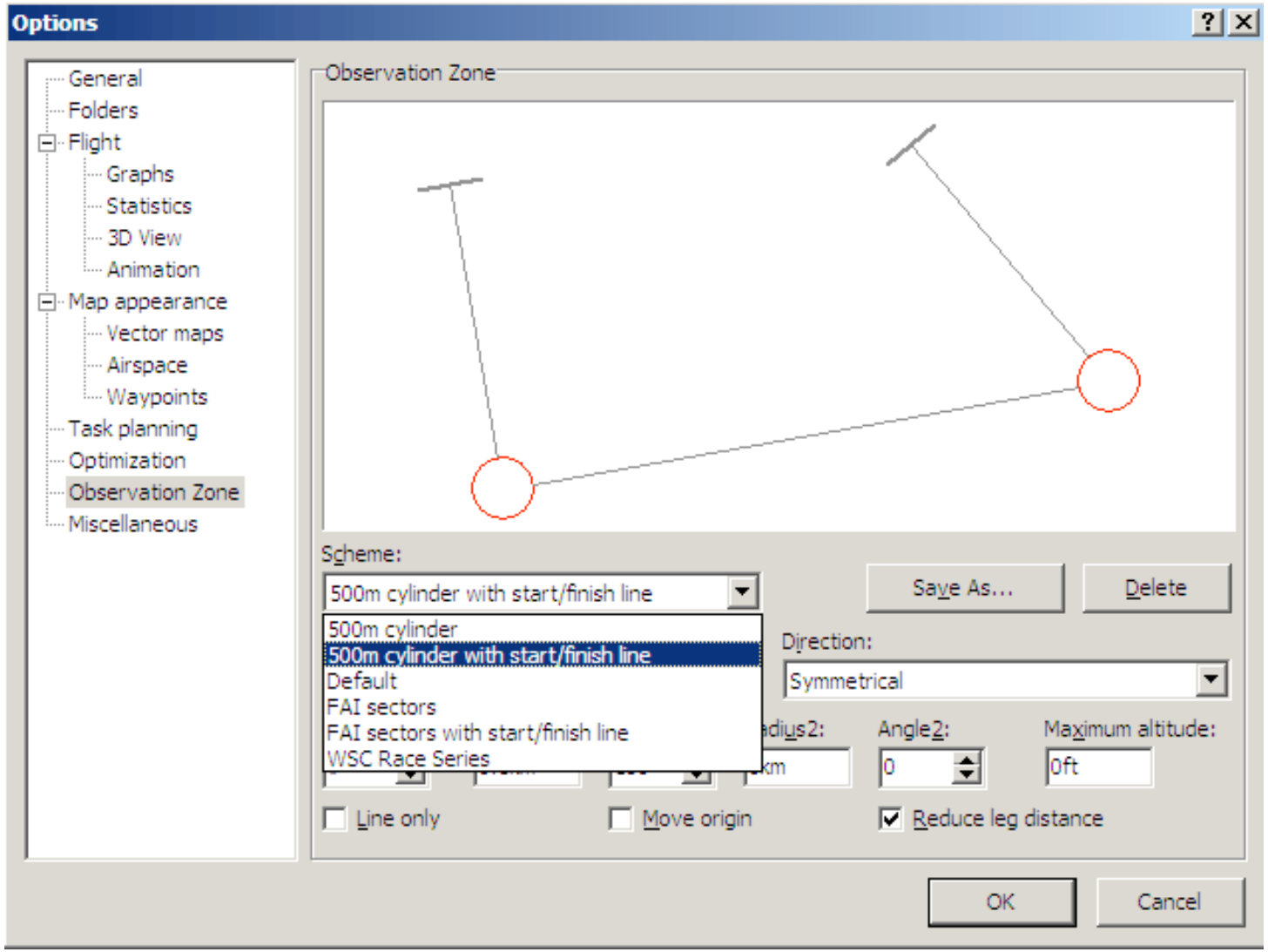
Without Fancy Toys

- Simple handheld GPS can display distance to waypoints
- Mark up sectors on a sectional
- Make sure all waypoints coordinates are the same, location on map is carefully chosen
- Don’t cut things close
- Exact position of sector arms depends on start off tow location.


Expected start off tow
SOUTH COUNTY (E16)
SAN LUIS (0O0)
Los Banos
LOS BANOS (LSN)
AWOS-3 118.675
Santa Rita Park
GILROY
FRAZIER LAKE (1C9)
HOLLISTER (CVH)
AWOS-3 120.425
CATHEDRAL PEAK
microwave station
substation
windmill
DOS PALOS
Sargent
Aromas
San Juan Bautista
Hollister
CHRISTENSEN
Oro Loma
EAGLE (Pvt)
DIABLO RANGE
Tres Pinos
race track
Paicines
SALINAS
SALINAS (SNS)
See NOTAMs/Directory for Class D eff hrs
PANOCHE
112.8 Ch 75 PXN
RANCHO
Mercy Hot Springs
FIDDO
PANOS
BASEC
EBULE
RANCK
CANRI
V 230
V 87
SPRECKELS
Chualar
VORTAC SALINAS 117.3 Ch 120 SNS
OAKLAND
CHUALAR
Gonzales
CTC NORCAL APP WITHIN 20 NM ON 133.0 251.15
Llanada
Panoche
San Benito
prison
power station

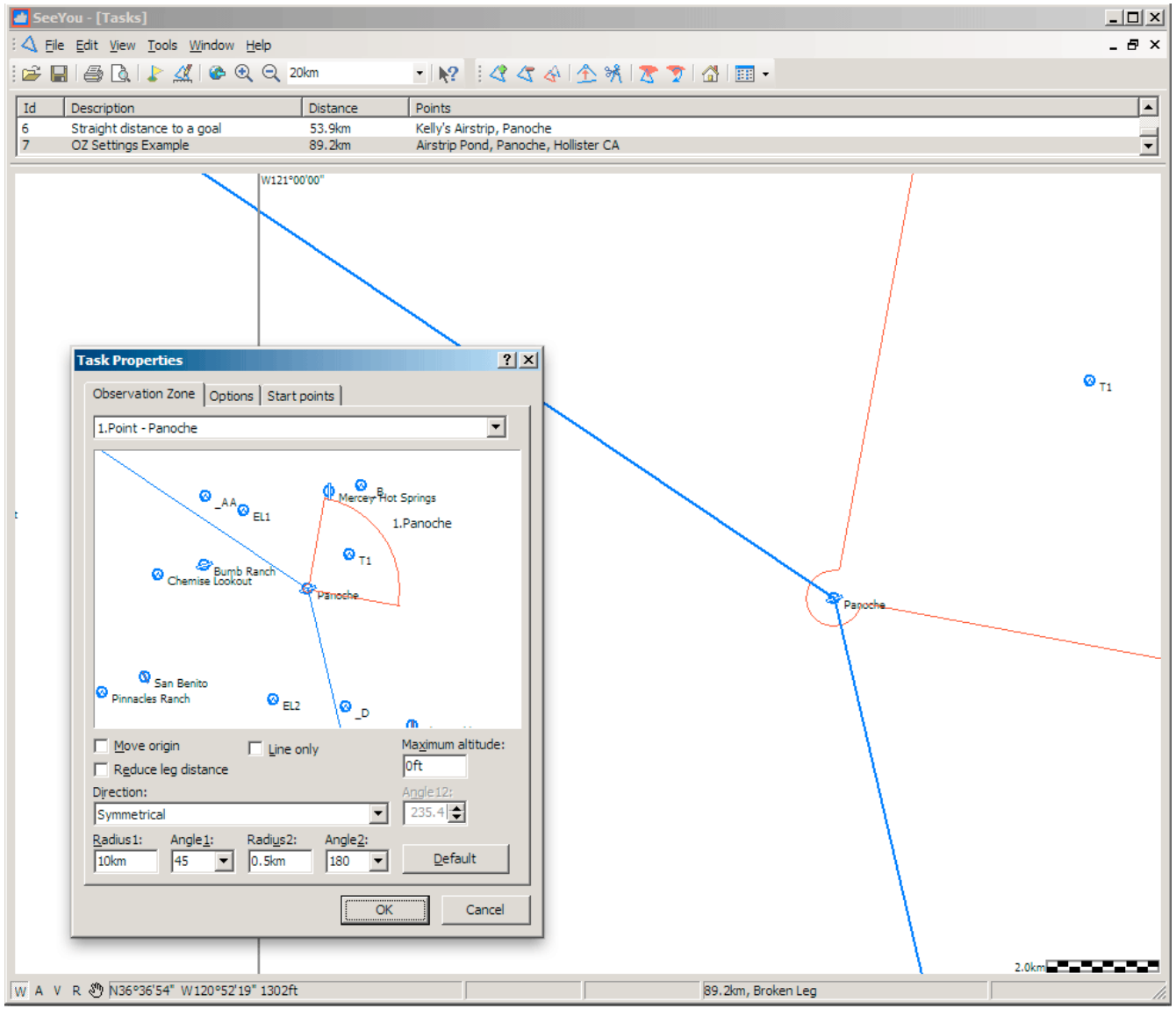
Fun with SeeYou and SeeYou Mobile

Global OZ Options



Use schemes – but the default FAI sectors may be WRONG! (3km settings)

Sector + Cylinder OZ



Sector + Cylinder OZ

IGC Flight Recorders

IGC Flight Recorders

- Greatly simplify many badge flights
- GPS based logger
- Electronic task declaration (before flight)
- Pressure altimeter + external calibration
- Unique ID
- Anti-tamper seal and digital signature
- Engine noise level (ENL) detection (option)
- May do, navigation, STF, NMEA out, ...
- Often poor usability, bugs and gottchas

IGC Flight Recorders

- Flight recorder approval documents
  - www.fai.org/gliding/gnss (at bottom of page)
  - Read the document for your flight recorder
  - May require sealing to glider or other things
  - May be valid for badges but not records
- IGC Specifications
  - www.fai.org/gliding/gnss/tech_spec_gnss.asp

IGC Flight Recorder

- Other flight recorders/loggers
  - SeeYou Mobile and WinPilot etc. can log flights
  - Garmin GPS etc. with conversion utilities
  - OLC will accept some of these for some flights
  - Not valid for any badge flight
  - No use at all as backup for the badge claim
- Backup IGC flight recorders
  - Need to be attached/sealed, declaration made, OO witness download etc.
  - Both must have same declaration
  - Two different declarations might invalidate flight

Flight Recorder Calibration

- IGC flight recorder calibration
  - 24 months before or 2 months after flight
- Most uses of recorder require calibration
  - Except of continuity of flight (e.g. duration)
- Pressure senor calibration on paper only
- NMEA out or display altitude not calibrated
- SeeYou pressure altitude not calibrated

CAMBRIDGE AERO INSTRUMENTS

1565 Dancy Blvd. Horn Lake, MS 38637
Phone: 662-280-7610 Fax: 662-280-7609
www.cambridge-aero.com

Barograph Calibration

The following information is a record of the barograph as it was recorded on the date of calibration.

Recorded By: QB Calibration Date: 3/13/07

INSTRUMENT INFORMATION

Product: 300 Series Model: 302

Serial Number: 4EM Software Version: 2.63

Factory Seal Secure: Yes ✓ No ____ kts ✓ m/s ____

Transfer and Save Flight Logs: Yes ✓

MASTER ALTIMETER CALIBRATION STATION DATA

Serial Number: R2594 Calibration Date: 2/23/07

Field Elevation: 25

INSTRUMENT CERTIFICATION

True Altitude in Feet	Instrument Barograph Display
Field Elevation	21
2,000	1996
4,000	3999
6,000	6002
8,000	8001
10,000	10004
20,000	20004
30,000	30020

Motor Run Sensor

100 % of Calibration Value (measure value/ calibration value)

Declarations

Declarations

- Only required for some flights
- May be useful for others
- Tells who you are and where you are going
- Only one declaration can be active
- One with latest time made is the valid one
- Can be written or electronic or both

FAI FLIGHT DECLARATION

WRITE BIG & PHOTOGRAPH FOR FILM DOCUMENTED CLAIMS

a.) DATE OF FLIGHT: _____

b.) NAME OF PILOT:(print)_____

c.) SAILPLANE MODEL & REGISTRATION:_____

d.) BAROGRAPH OR GPS MODEL & SERIAL #:_____

e.) DECLARED START POINT: (Other than release from tow)

PLACE NAME:_____ LAT:_____ LONG:_____

f.) DECLARED TURNPOINTS:

#____ NAME: _____ LAT: _____ LONG:_____

____ NAME: _____ LAT:_____ LONG:_____

____ NAME:_____ LAT: _____ LONG:_____

Number turnpoints prior to the flight *ONLY* if you are declaring a designated sequence. Fill in turnpoint numbers after the flight for a Three Turnpoint Distance badge course.

g.) DECLARED FINISH POINT/GOAL:

PLACE NAME: _____ LAT: _____ LONG:_____

h.) DATE OF DECLARATION:_____**TIME**:_____

i.) PILOT'S SIGNATURE: _____

j.) OBSERVER'S NAME: (Print) _____

k.) OBSERVER'S SIGNATURE: _____

Declarations

- Paper forms
  www.ssa.org > Soaring Achievement > Badges
- Careful using waypoint names
  – Coordinate sheet must be attached before flight
- Make sure lat/lon units are clear
  – e.g. hhmm.dd vs hhmmss.dd
- Take off and landing (unless a goal) are not part of declaration
  – Flight recorders may have this as FYI only
- OZ style not part of declaration
- Badge type or leg is not part of declaration
  – One flight may be used for multiple badge claims

Electronic Declarations

- Start off tow – just don’t declare a start
- Landing finish – just don’t declare a landing
- Making the task active on PDA is not a declaration
- Practice with PDA software and flight recorder
- Make declarations on every flight
- Download every flight
- Always validate flight logs
- Look at flight in SeeYou

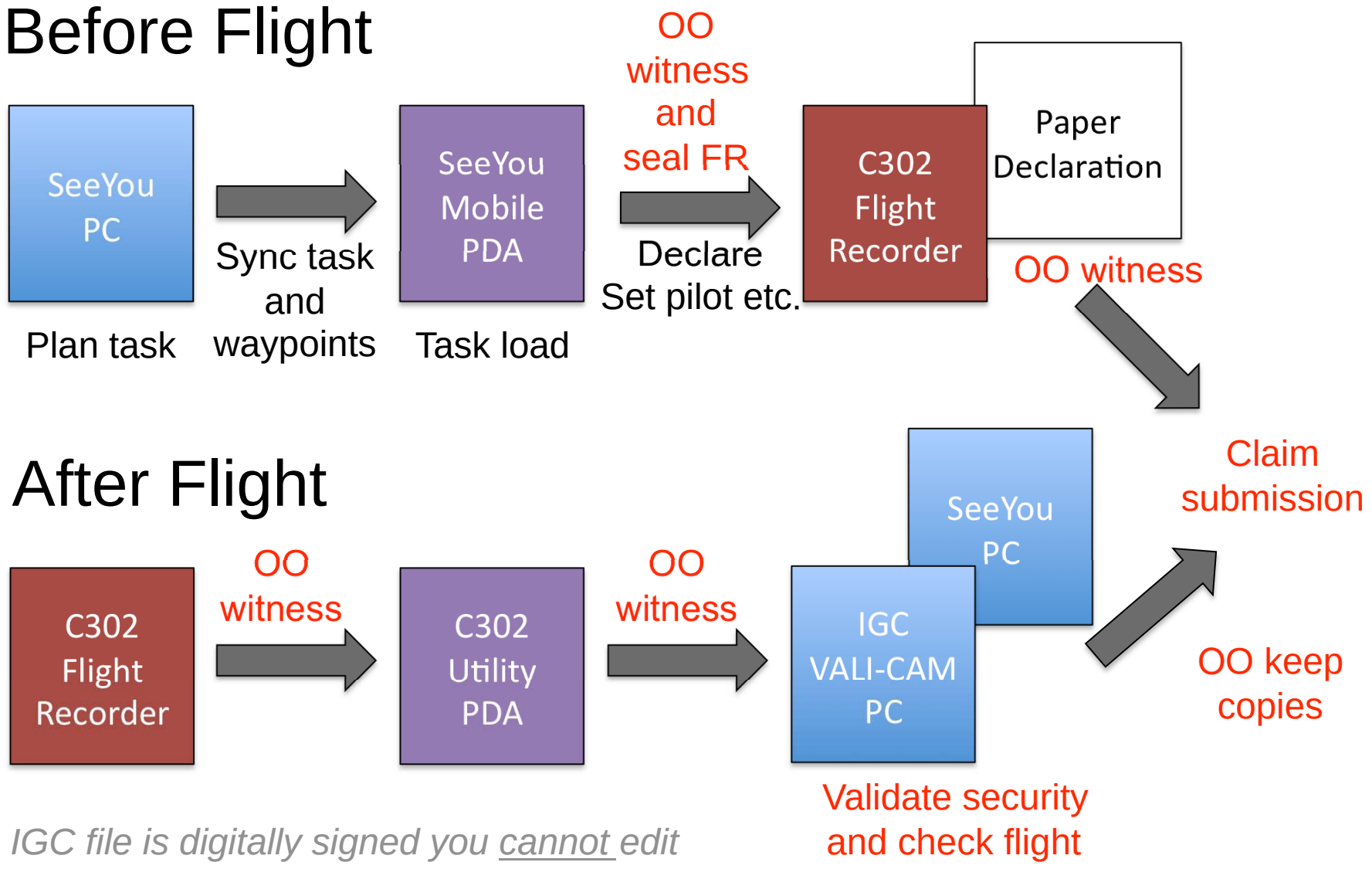
Flight Recorders

- Pilot and glider info is usually not set in the electronic task declaration
- Set separately – make sure you do this
- Cannot edit the flight log to fix pilot info etc.
- For badges – OO send Judy explanation

Paper + Electronic

- Turn on the IGC flight recorder
- Set/check pilot and glider information
- Make electronic task declaration
- Do not turn off the flight recorder
- Sign paper declaration and witness by OO
- Fly…
- Download flight log
- Validate and check flight log
- Submit paper and IGC file

Sample Flight Recorder Workflow



IGC file is digitally signed you cannot edit

Bugs and Stupid Gottchas

- Cambridge 10, 20 and 25 overwrite
  - New declaration will overwrite the ones in previous flights
- Cambridge 10, 20, 25 or 302 “security fail”
  - Get batteries replaced during calibration
- Cambridge 302 “security fail”
  - If seal OK try “clear log”, upgrade flash chip
- Calibri (other LX?) factory calibrations invalid
  - Not properly stamped and signed
- Volkslogger “declare at power-on”
  - Declaration gets power-on date and time
- Two-step declaration “entry” and “activation” (EW, …)
- Flight recorders and PDA software problems
  - e.g. Start and/or finish point declared as a turn point
- Physical and electronic serial number mismatch
- Many bugs in various upload/download utilities

1% Rule

SC3 4.4.2 Loss of height and application of the height penalty

a. For distance flights of more than 100 kilometres, where the loss of height (1.2.7) exceeds 1000 metres, a height penalty (1.2.12) must be subtracted from the length of the course to give the official distance.

b. For distance flights of 100 kilometres or less, a loss of height exceeding 1% of the length of the course will invalidate the soaring performance.

c. For speed and duration flights, a loss of height exceeding 1000 metres will invalidate the soaring performance.

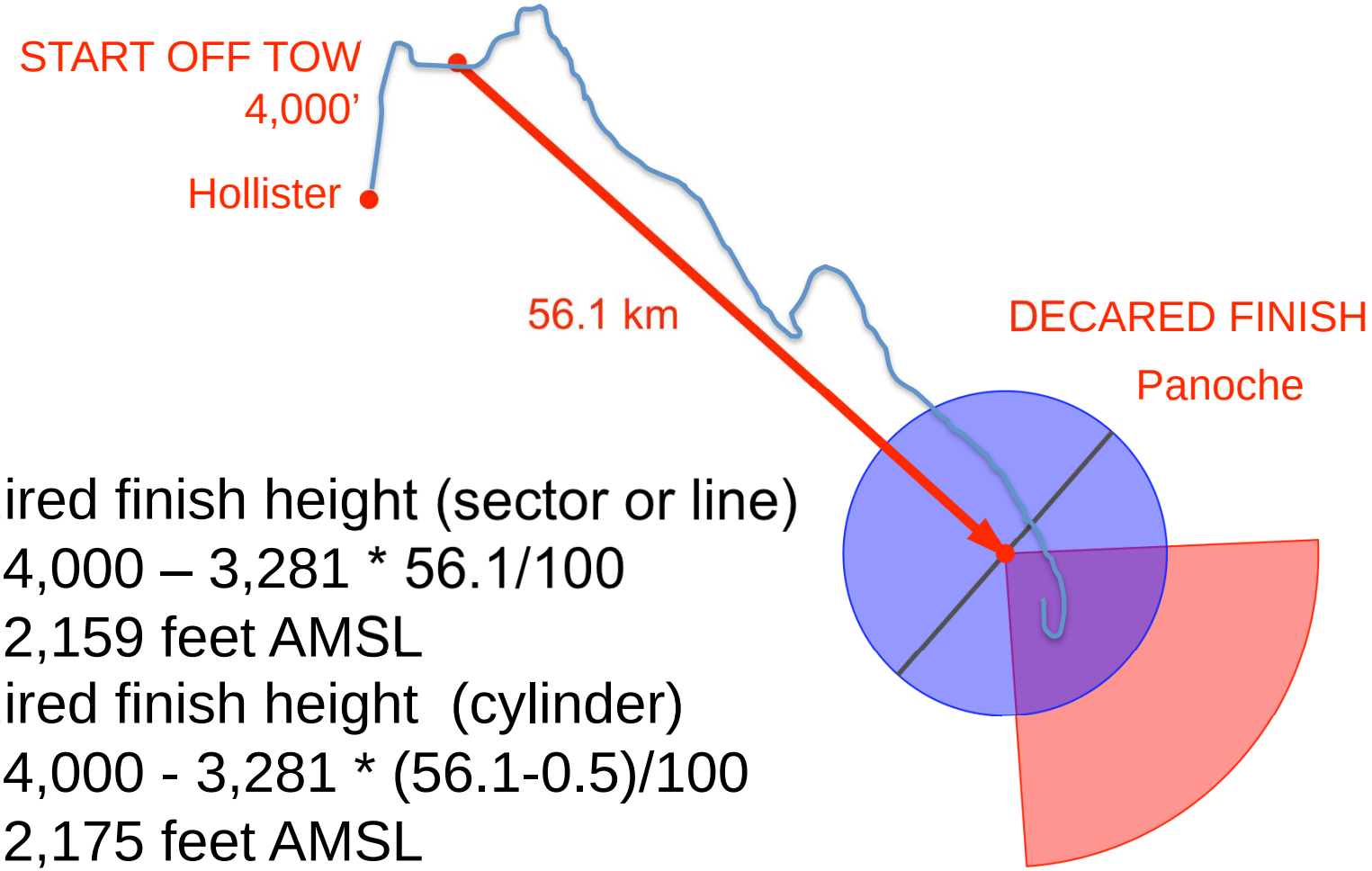
1% Rule

- Silver badge 1% applies to whole course, not just the 50km leg
- Remember cylinder 500m leg reduction
- With a landing finish know your maximum start height
- With a declared finish point know your minimum arrival altitude
- Always leave a good safety/error margin
  - At least 150’
- Reset QNH for long distance/time flights
- Do not rely on GPS altitude !

Hollister to Panoche
No Declarations

Max release = 3,281 * 56.1/100 + 1,342
= 1,840 + 1,342
= 3,182 feet

Hollister to Panoche
Declared Finish, 4,000’ Start



Required finish height (sector or line)

= 4,000 – 3,281 * 56.1/100

= 2,159 feet AMSL

Required finish height (cylinder)

= 4,000 - 3,281 * (56.1-0.5)/100

= 2,175 feet AMSL

Note FAI sector location determined by START OFF TOW

Start and Finish Times & Altitudes

Start	Finish
Tow release or MoP end	End of landing roll
Exit start OZ	Enter finish OZ
Cross start line	Cross finish line
Low point in start OZ*	High point in finish OZ*
	MoP start**

- * Flight recorder only (SC3 4.3.1 & SC3c 3.5)
- ** Only for straight-out distance, duration or height
- Most favorable start and finish can be used
- Different times/altitudes can be used for different soaring performances

Altitude

Altitude

- Altitude is measured with pressure not GPS
  - GPS can only be used to prove continuation of flight
- *Everything* else uses pressure altitude
  - Start altitude, finish altitude, altitude gain, airspace, etc.
- Know what the Flight Computer, Logger and PDA, shows
  - e.g. Cambridge 302 displays QNH adjusted pressure altitude
  - PDA software can usually display GPS and/or pressure altitude (if logger or computer provides this to PDA)

Altitude

- Know where to get QNH and adjust altimeter, flight computer, etc. during flight
- Leave safety margins of a few hundred feet
- Post flight QNH correction
  - If necessary Judy will retrieve the records from local reporting stations to correct the pressure altitudes in the flight log
- SeeYou knows about one QNH setting
  - You have to set it manually (Edit>Flight Properties)
  - You have to change this manually if QNH changes over time or location

Altitude Gain

- Silver: 1,000m (3,281 ft)
- Gold: 3,000m (9,843 ft)
- Diamond: 5,000m (16,405 ft)
- Use an IGC flight recorder
  - Easier than a barograph
  - No declaration required
  - Calibration required
  - Clearly mark off tow by turn or notch
- QNH change may be factor
- Don’t cut altitude close, allow few hundred feet
- If using wave window, OO should include information
- Do not violate FARs

Silver & Gold Duration

Silver & Gold Duration

- SC3 2.1.1b Silver and 2.1.2b Gold badge
  - "A duration flight of at least 5 hours"
- SC3 1.2.5 "Duration" definition
  - "time elapsed between start time and finish time"
- SC3 1.4.2c
  - No declaration required
- SC3 4.4.2c
  - "… a loss of height exceeding 1,000 meters will invalidate the soaring performance"

“Classic” Duration

- Often assumed a start off tow to landing
- Watch out for max 1,000m height loss
- Use an IGC flight recorder
  - Easier than continuous observation or barograph
  - Does not need to be calibrated – use tow pilot release height (GPS used to show continuity of flight)
  - Easier still to use a calibrated recorder and mark off tow
- Note start time – write it down
- Fly a little longer than needed
- Do not violate FARs, esp. sunset
- Motor gliders can start MoP to end flight before losing 1,000m

Declared Start and/or Finish

- Allows duration claims where you need to tow higher then 1,000m above landing
- Can use declared start and/or finish points
- Can start off tow to declared finish
- Still with 1,000m maximum height loss
- Use an IGC flight recorder
  - Does need to be calibrated
  - Make an declaration (electronic and paper)
- Note start time – write it down
- Fly a little longer than needed
- Explain the basis for the claim

Duration Start and Finish

- Mix and match from the following –

Start	Finish
Tow release or MoP end	End of landing roll
Exit start OZ	Enter finish OZ
Low point in start OZ*	High point in finish OZ*
Cross start line	Cross finish line
	MoP start

- * Flight recorder only (SC3 4.3.1 & SC3c 3.5)
- Different times/altitudes can be used for different badge legs

Misc

Sunset

- Whole flight must normally be between sunrise and sunset
- Sunset not end of civil twilight
- 14CFR 91.209 – position and anti-collision lights required between sunset and sunrise
- Times from US Naval Observatory
  www.usno.navy.mil/USNO/astronomical-applications/data-services/rs-one-day
- Do not turn off the flight recorder

Badge Distance Flight Types

- Straight distance to goal (SC3 1.4.4a)
  - Start to a declared finish, no turnpoints
- Distance using up to three turnpoints (SC3 1.4.4b)
  - Landing finish need not be declared
  - Turnpoints at least 10km apart, claimed once in any order, or not at all
- Straight distance (SC3 1.4.5)
  - Start to finish with no turnpoints
  - No declaration needed if start off tow or unless finish is a goal
- Out and return (SC3 1.4.6 a)
  - Closed course with one turnpoint
- Three turnpoint triangle (SC3 1.4.6 b(i))
  - Closed course via three turnpoints independent of start and finish
  - 300km minimum distance
- Two turnpoint triangle (SC3 1.4.6 b(ii))
  - Closed course via start/finish and two turnpoints
  - Distance can be less than 300km

Distance Notes

- Only one declaration valid for each flight
  - Can make multiple claims from that declaration
- Silver Distance 50km
  - Straight course or leg of pre-declared course (SC3 2.1.1a)
- Diamond goal 300km
  - Out and return or triangle (SC3 2.1.3b)
- Out and return and triangles
  - Watch requirement for start and finish within 1,000m (SC 4.3.3)
- Missed turn point (SC3 4.2.2b)
  - Shorter closed course course can be claimed if a turnpoint is abandoned (i.e. turn a triangle into an out and return)
  - No turn points usable after a missed turnpoint
- FAI Triangle geometry
  - Does not apply to badges

Some Traps

- Extra turnpoints invalidate declarations
  - Waypoints must be used in the sequence declared except where specifically not required in the rules SC3 1.4.1(d)
  - No distance flight type has more than three turnpoints
  - Therefore any declaration with more than three turnpoints is invalid
- Badge declaration may conflict with racing tasks
  - Don’t put racing task in declaration
  - Use a paper declaration to be sure
- Free distance flights (SC3 1.4.3) not for badges

Claim Submission Checklist

- Pre-addressed and postage paid envelope
- Use latest SSA forms
- Include explanation *from the OO* for any unusual or possible suspect things
- Provide contact info for OO and pilot
- Include processing fee if not an SSA Member
- IGC File (on CD-R/RW is ideal, robust, cheap)
- Include paper declaration
- Photocopy of flight recorder calibration report
- Buy the OO, tow pilot, etc. a beer

The End

Now please read
FAI Sporting Code Section 3
FAI Sporting Code Section 3, Annex C
Your flight recorder IGC approval document.
Practice using your flight recorder.
Then go get your badges…