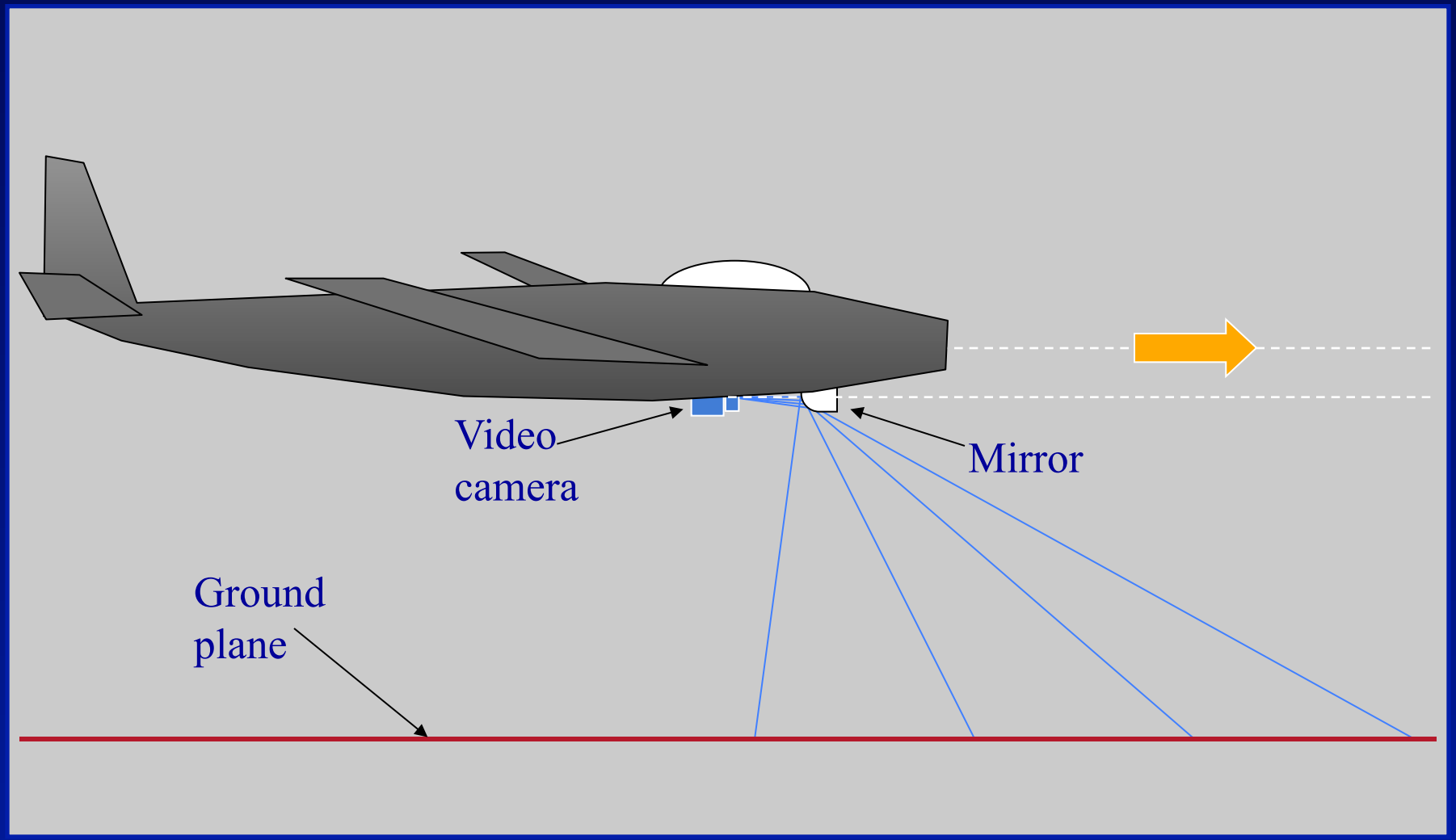
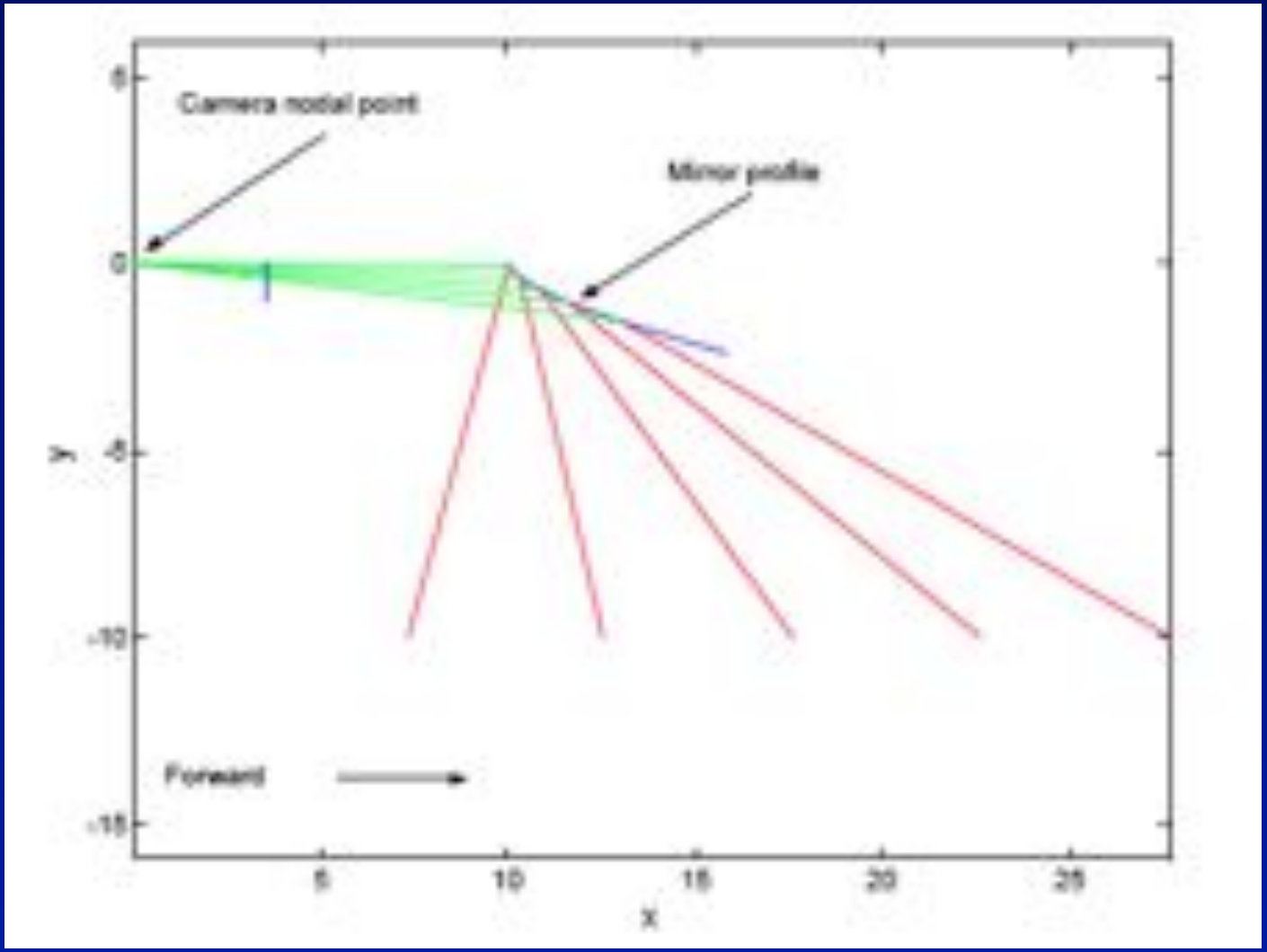
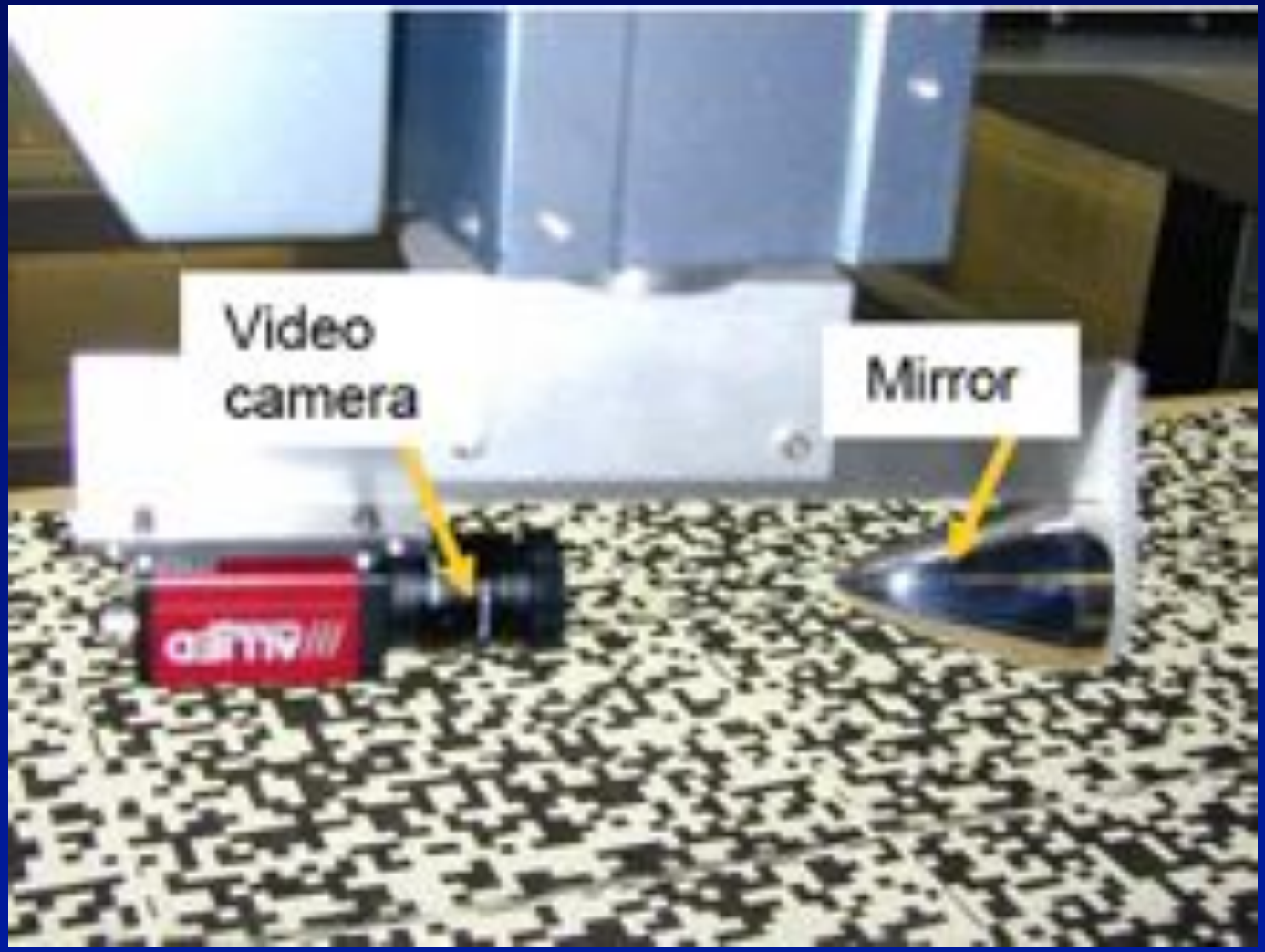


Illustration of vision system for visually guided terrain following and landing (not to scale). The vision system is shown on an enlarged scale relative to the aircraft in order to clarify its configuration.

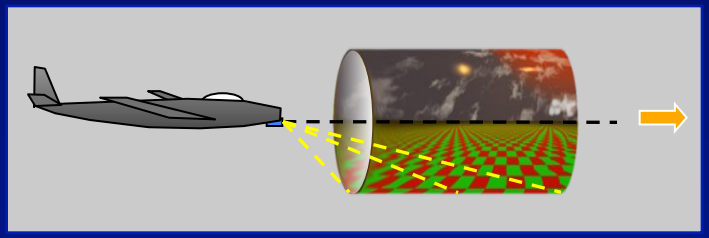
Design of terrrain-following mirror profile



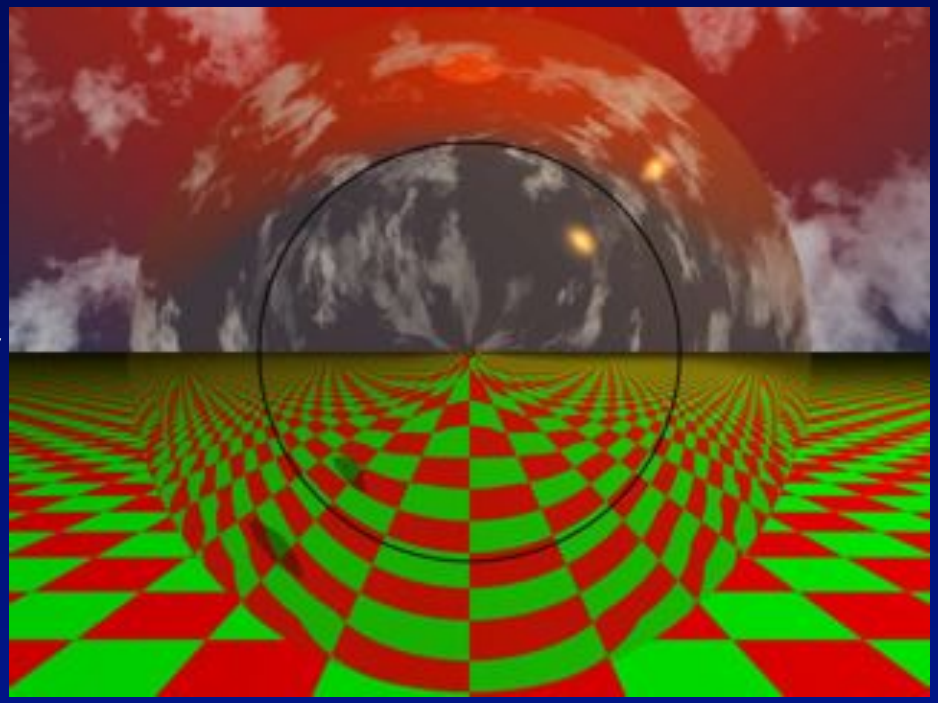

Video
camera
Mirror

Imaging properties

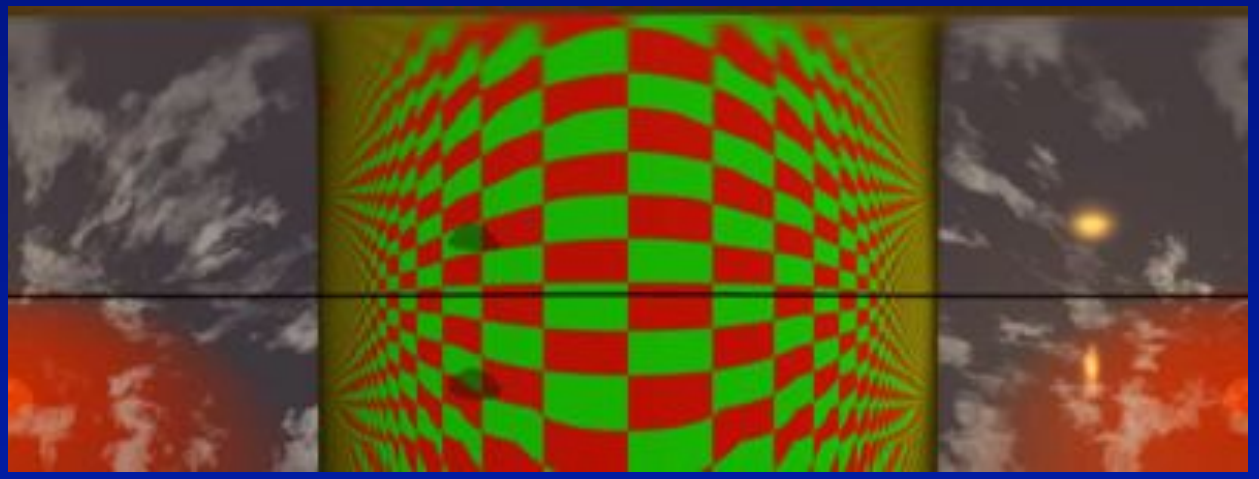
- *Removes perspective distortion*
- *Scales down image motion*
- *Defines a "collision free" cylinder*



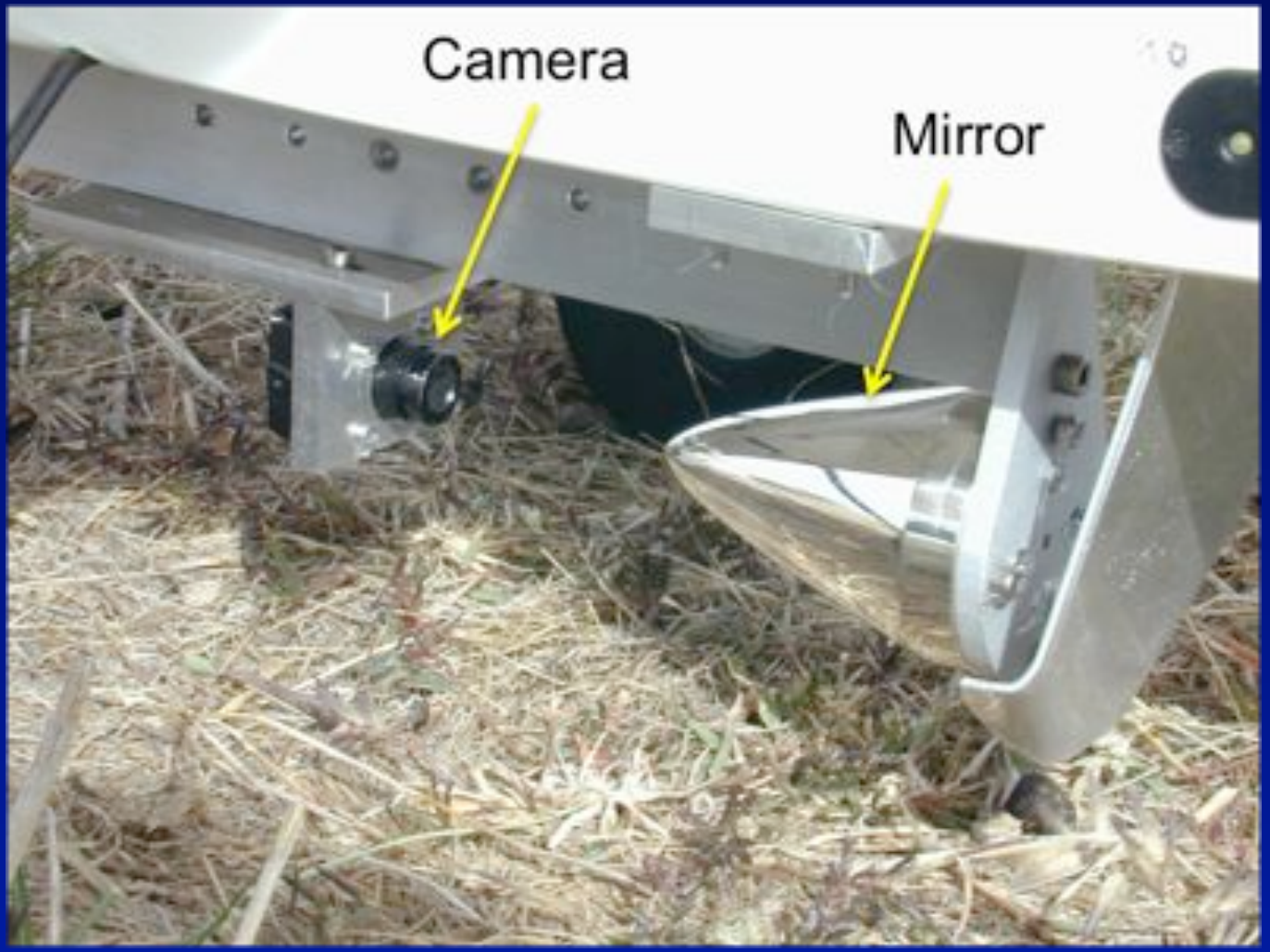
Centre of mirror →



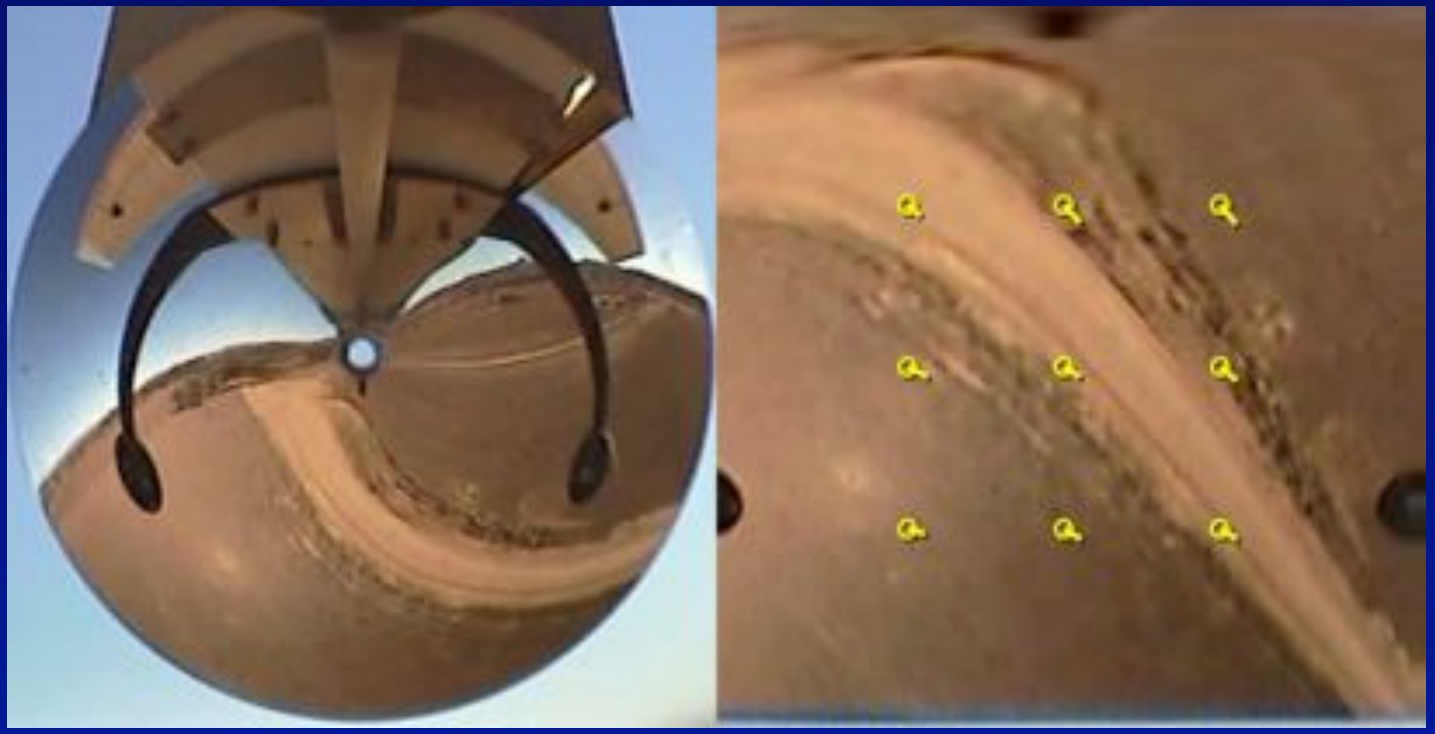
Work with Saul Thurrowgood and Dean Soccol



Digitally remapped version

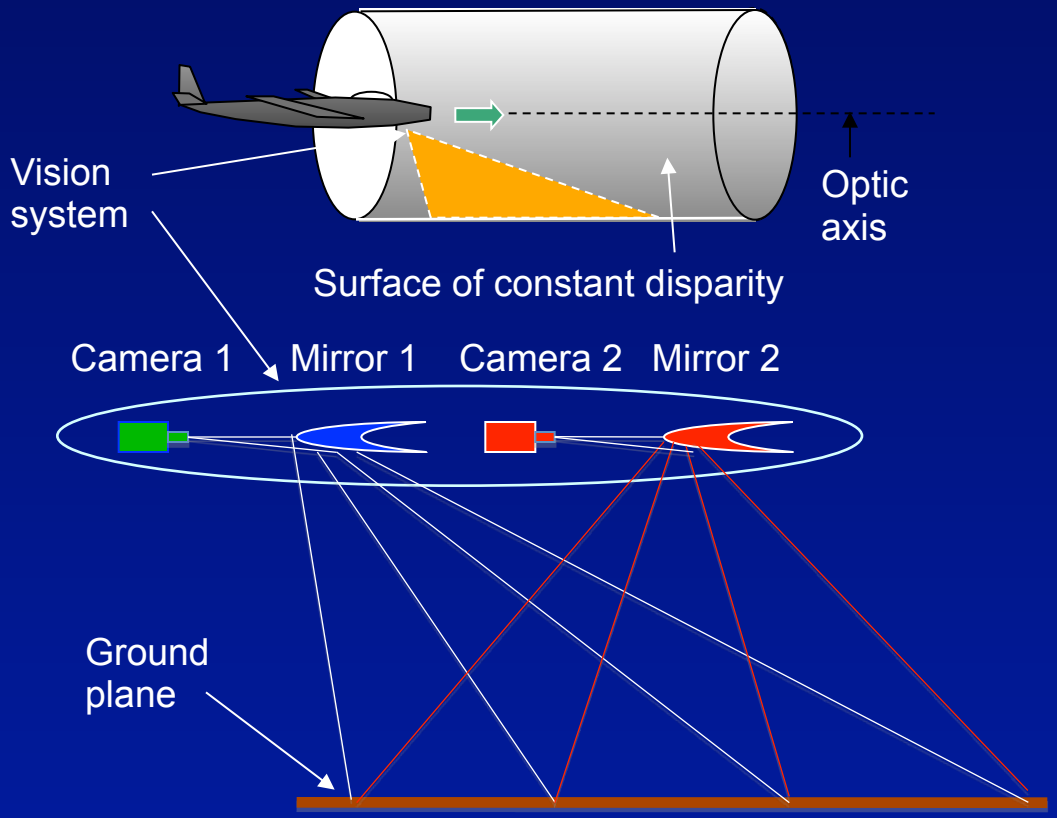

Camera
Mirror

Flight test -1

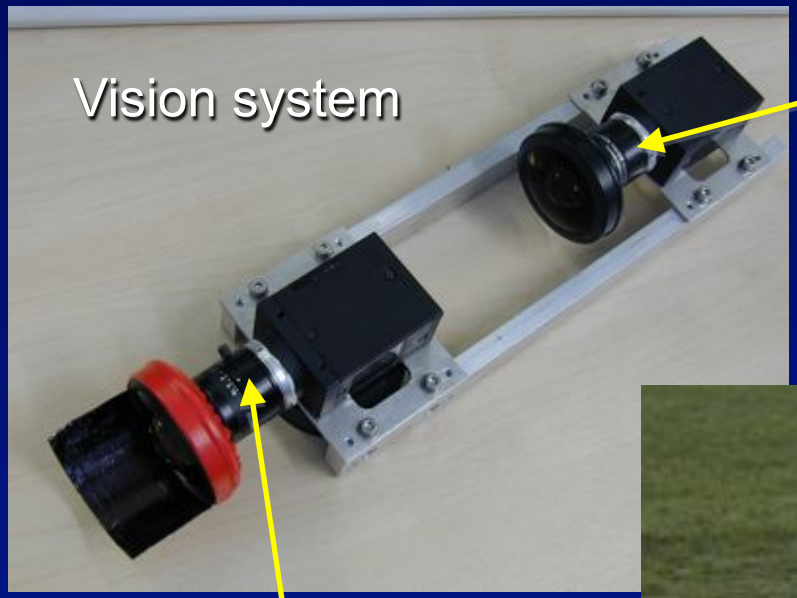


Work in progress with Saul Thurrowgood and Dean Soccol

Collision-free cylinder



Moore, Thurrowgood, Bland, Soccol, Srinivasan (2009)



Coaxial rear camera

Front camera

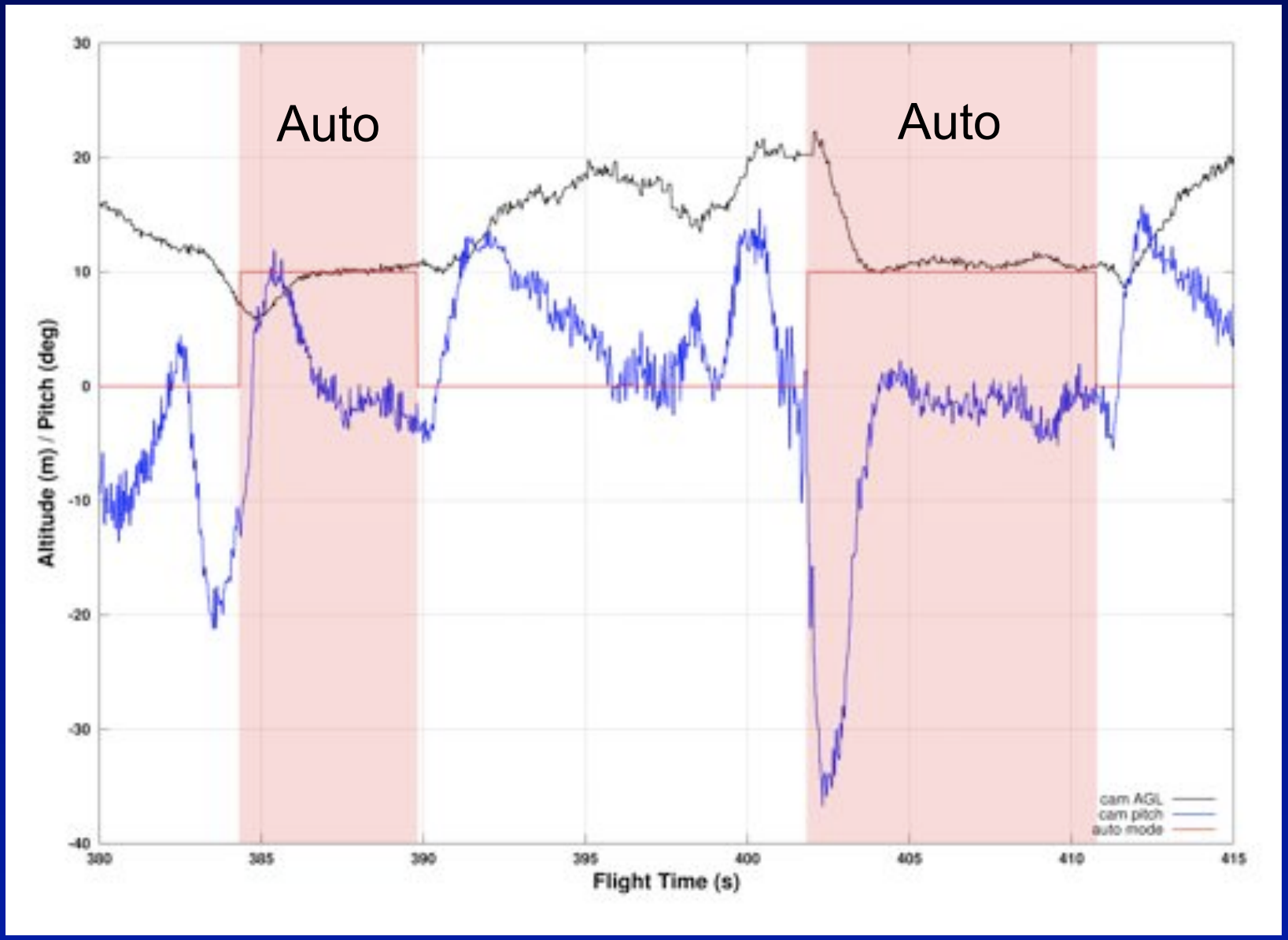
Vision system

Closed loop flight test

Field view

Front camera view

Moore, Thurrowgood, Bland, Soccol, Srinivasan (2009)

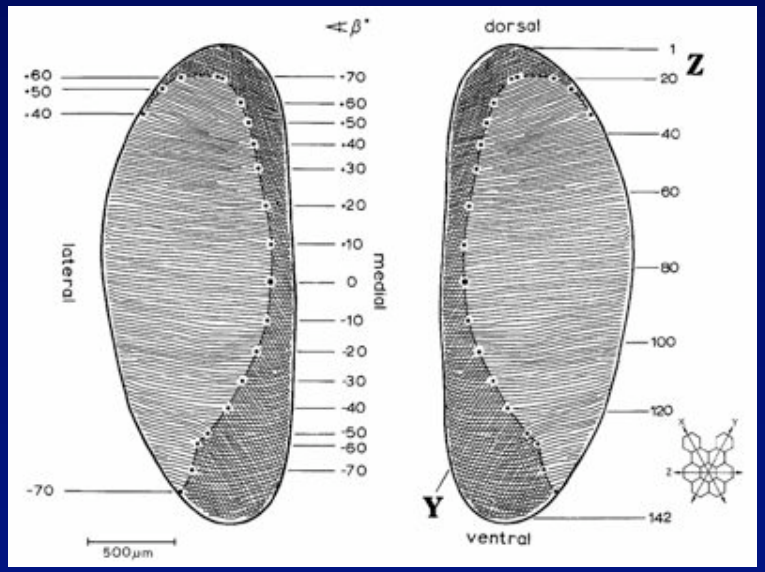

Auto
Auto
Altitude (m) / Pitch (deg)
Flight Time (s)
cam AGL
cam pitch
auto mode
30
20
10
0
-10
-20
-30
-40
380
385
390
395
400
405
410
415

The Ocelli

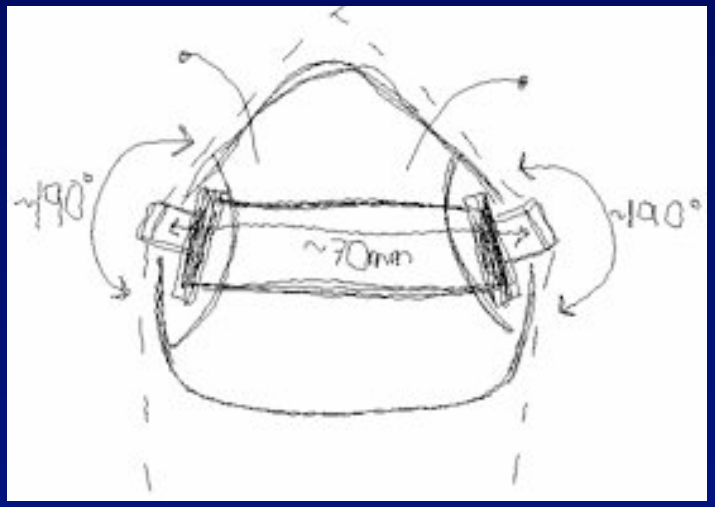
Visual horizon sensing

Image from Goodman (2000)

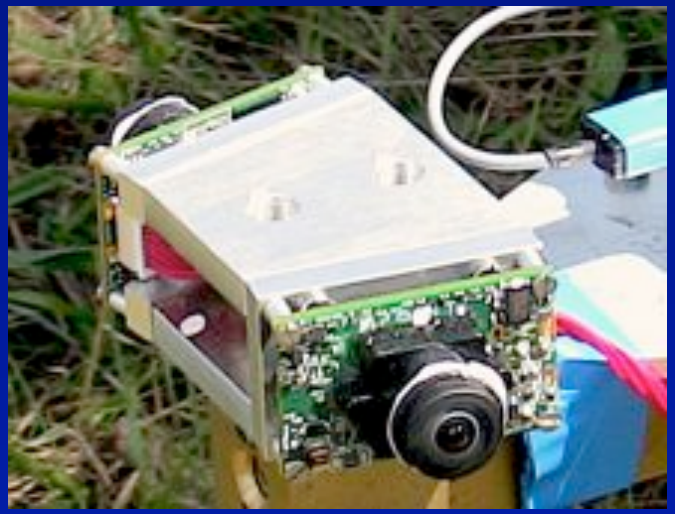
Bee Eye

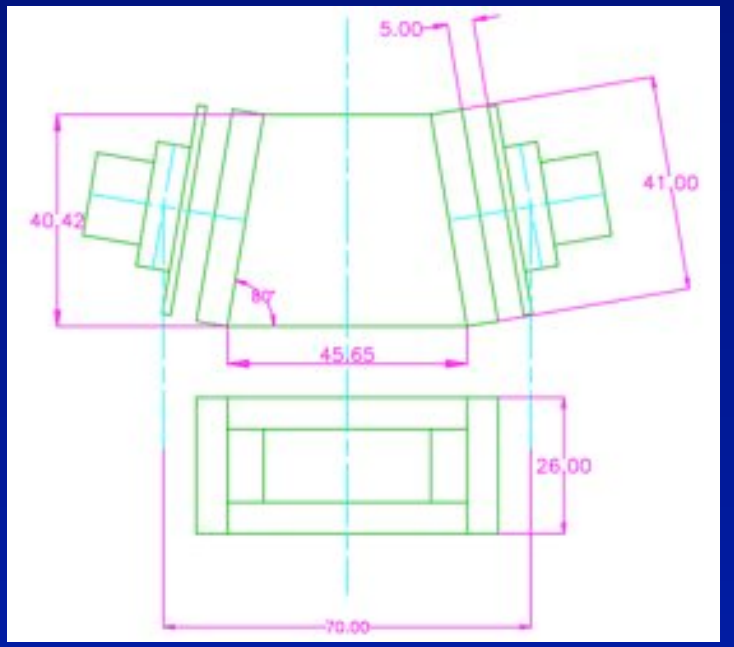


IEye

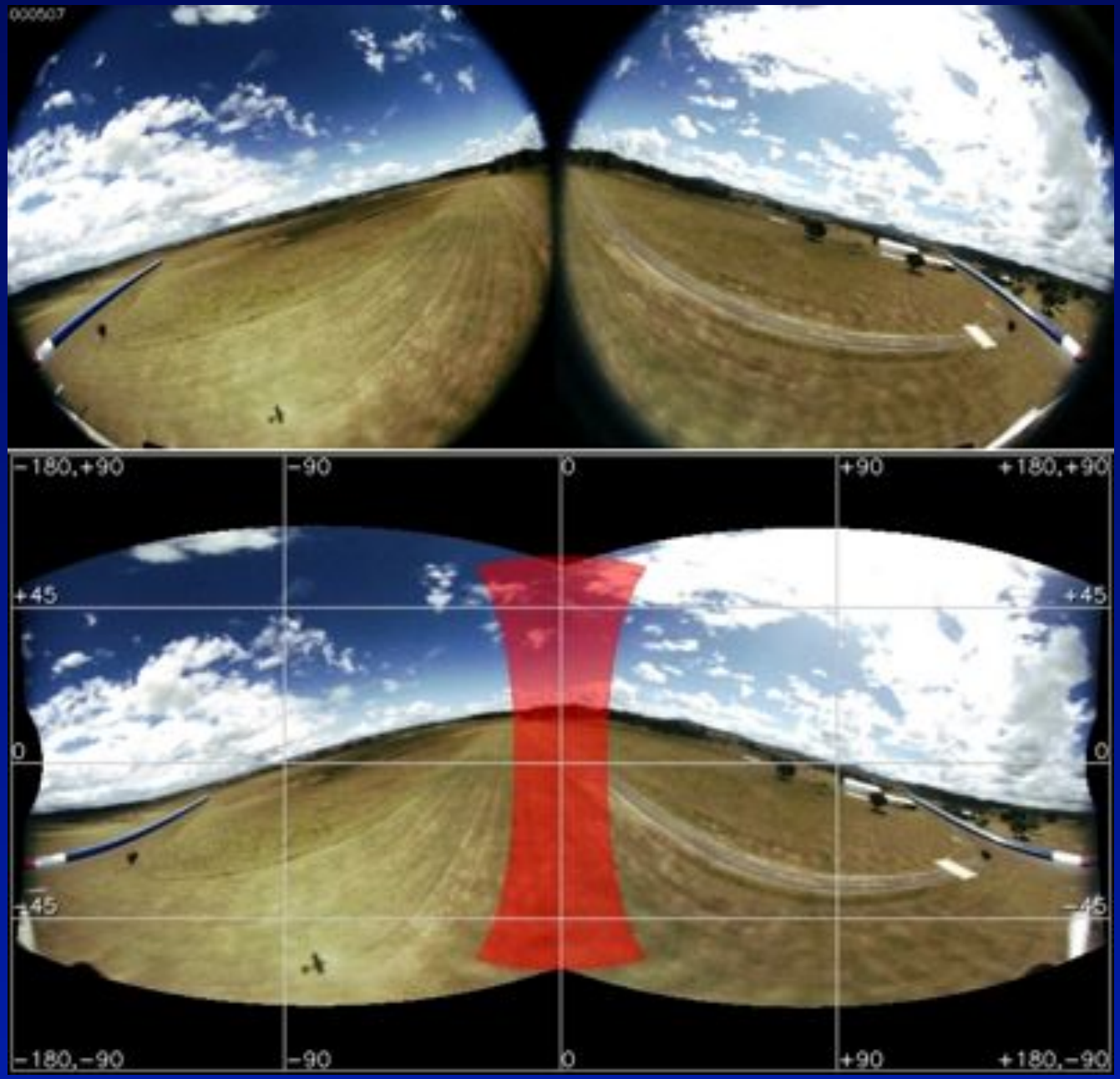


Design of I-Eye (right) to emulate the functionality of a honeybee eye (above)

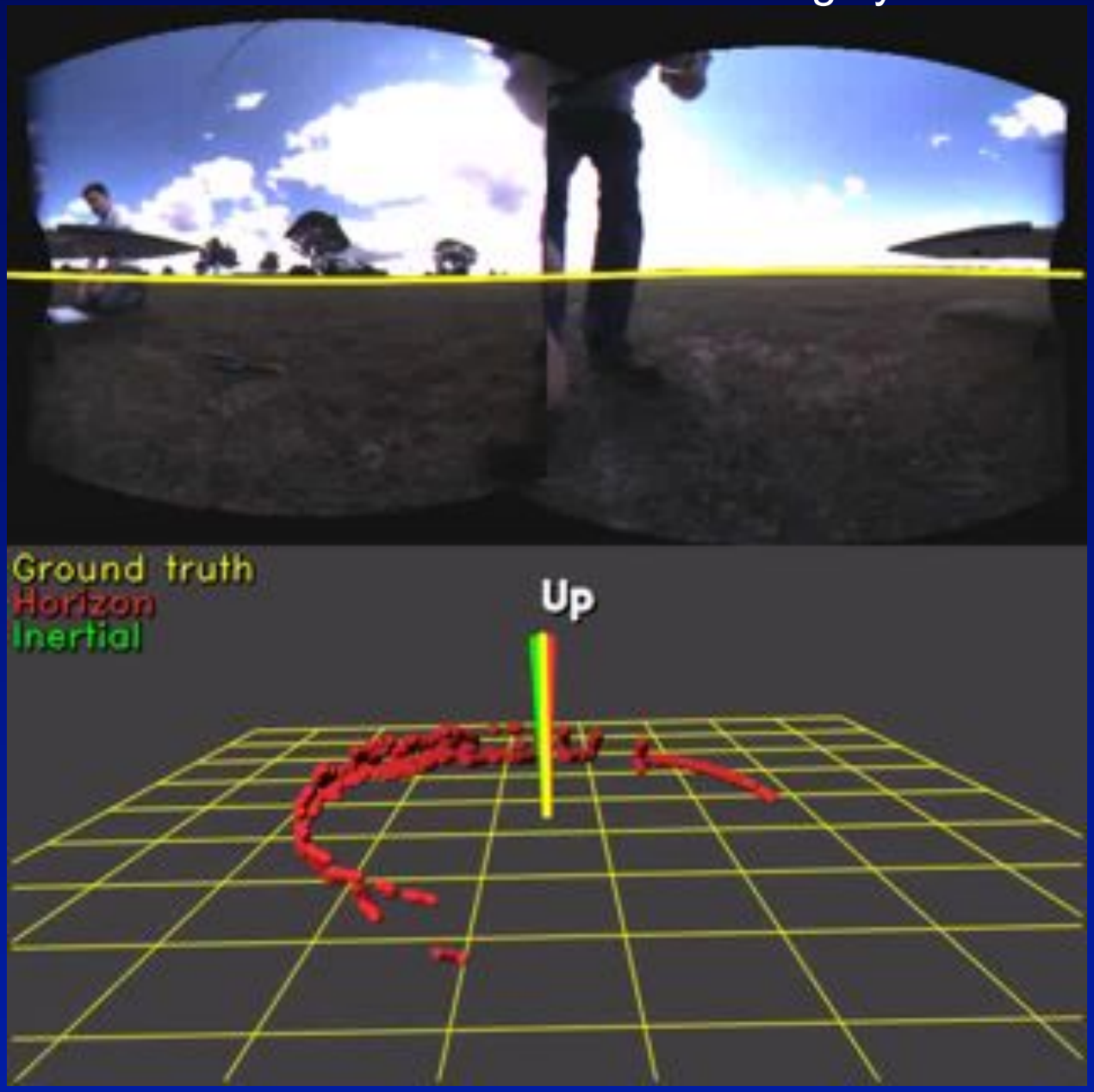




Thurrowgood, Moore, Bland, Soccol

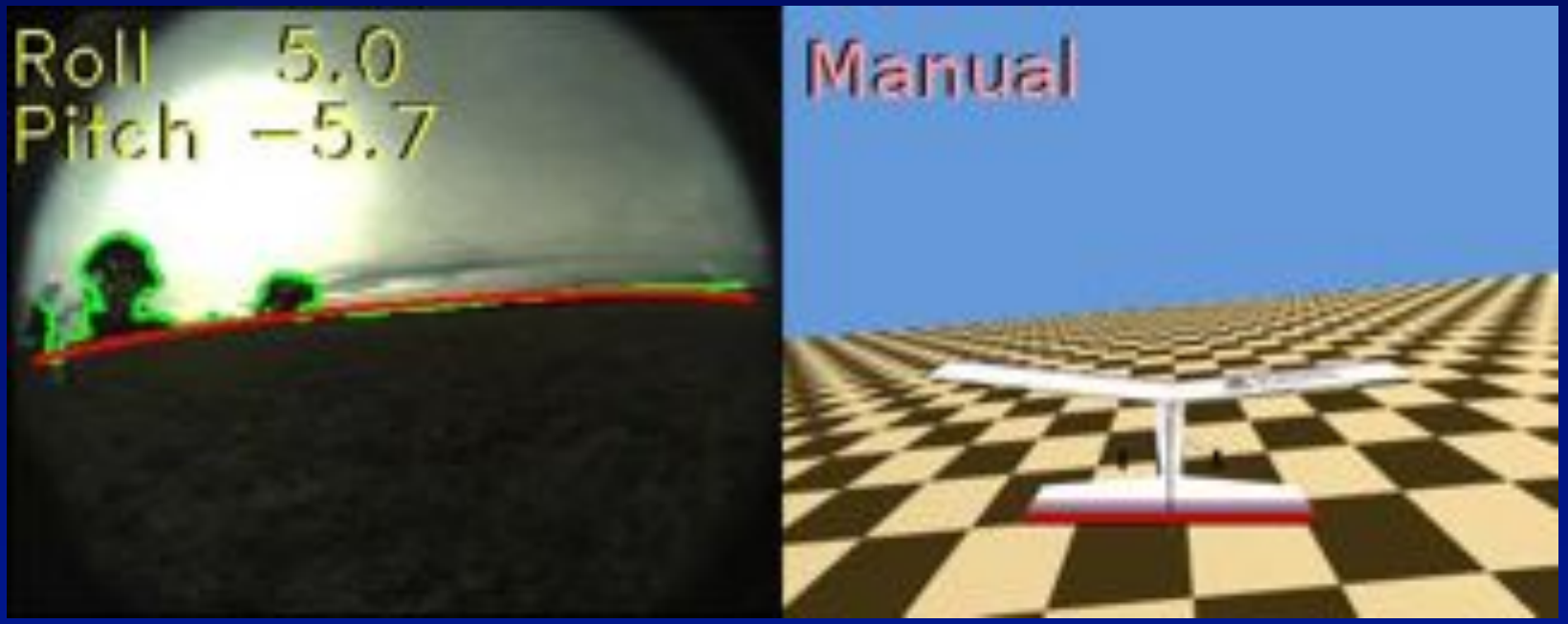

000507
-180,+90
-90
0
+90
+180,+90
+45
+45
0
0
-45
-45
-180,-90
-90
0
+90
+180,-90

Test of horizon-based attitude sensing system



Thurrowgood, Soccol, Moore, Bland, Srinivasan (2010)

Flight test: Horizon-based closed-loop control of roll and pitch



'Manual' : Human pilot controls attitude

'Automatic' : Horizon-sensing autopilot regulates attitude

(Roll: +40.0 deg; Pitch: -2.0 deg)

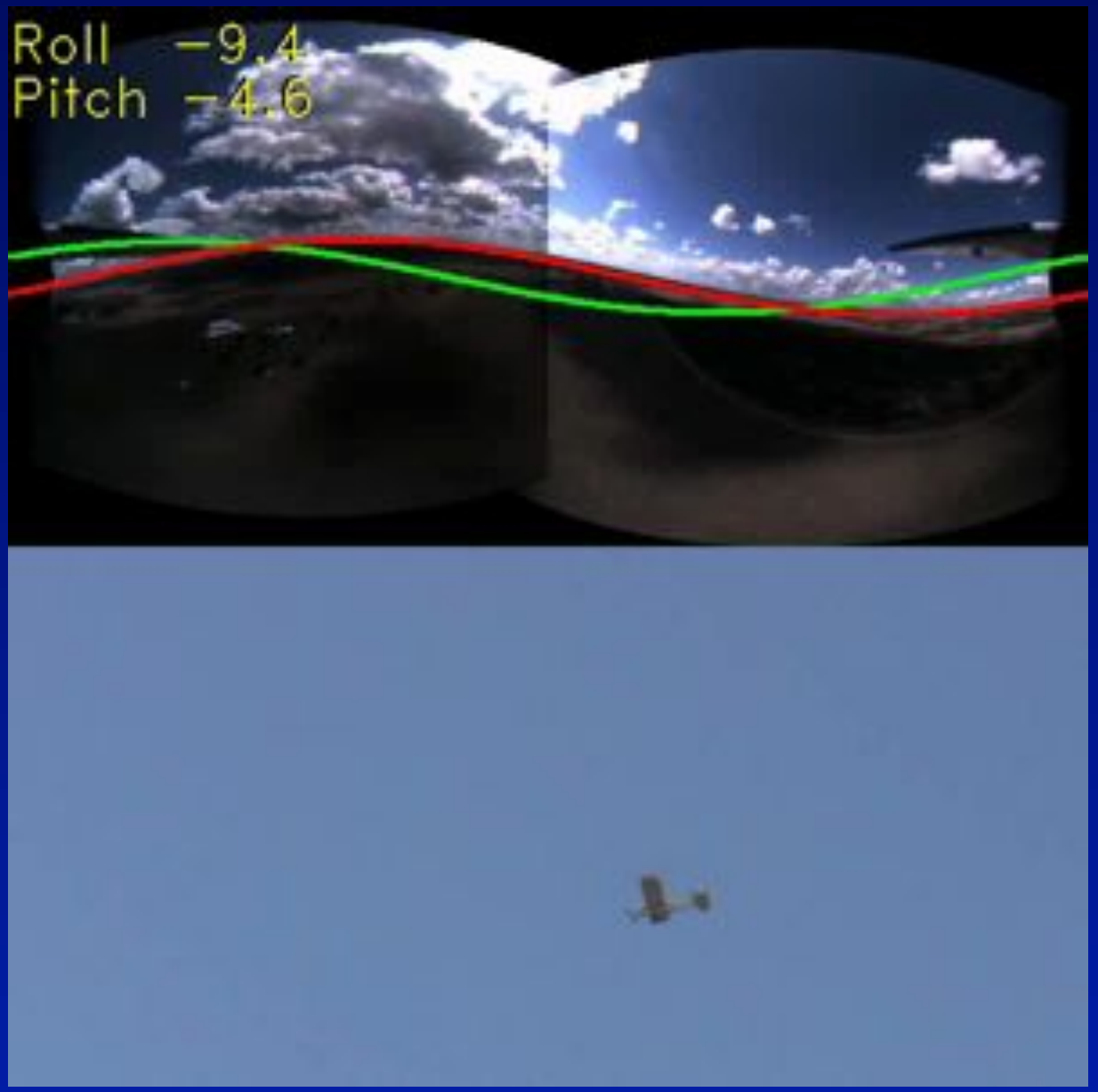
Thurrowgood, Soccol, Moore, Bland, Srinivasan (2009)

Example 1 Loop

Extreme maneuver accomplished autonomously by controlling the position of the horizon in the I-Eye vision system

Visual horizon

Inertial horizon

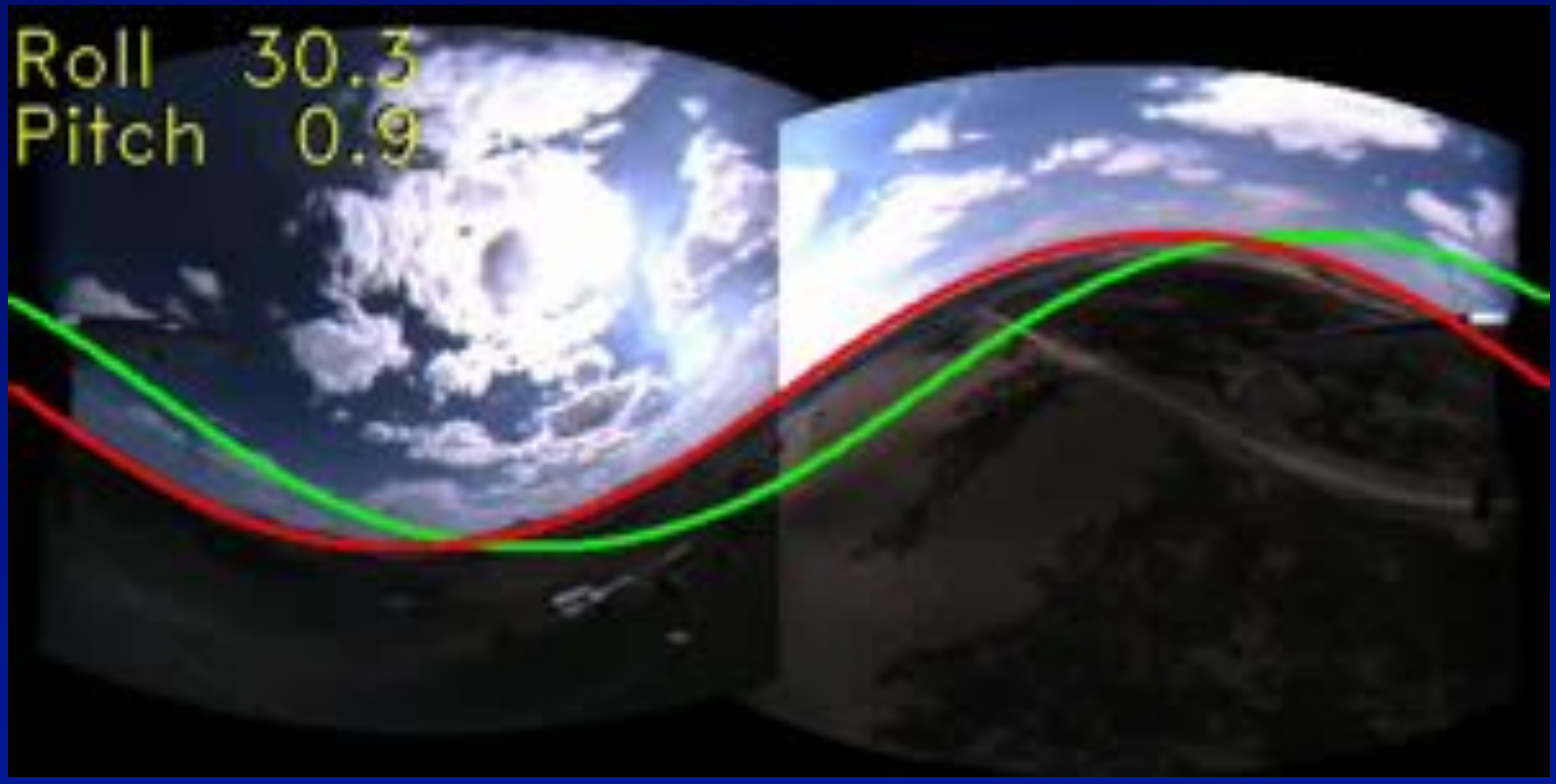


Thurrowgood, Soccol, Moore, Bland, Srinivasan (2011)

Extreme maneuver accomplished autonomously by controlling the position of the horizon in the I-Eye vision system

Visual horizon

Inertial horizon



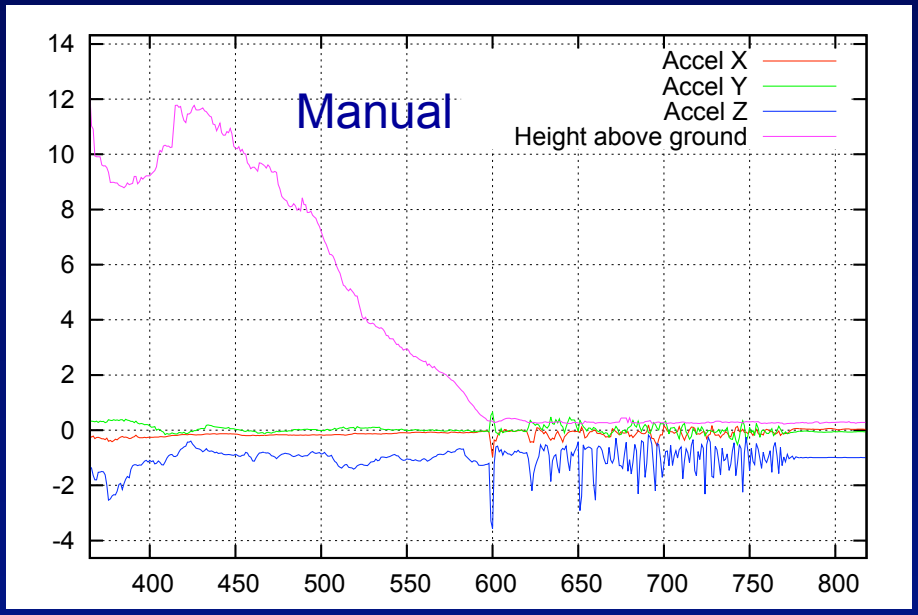
Example 2 -- Immelmann maneuver

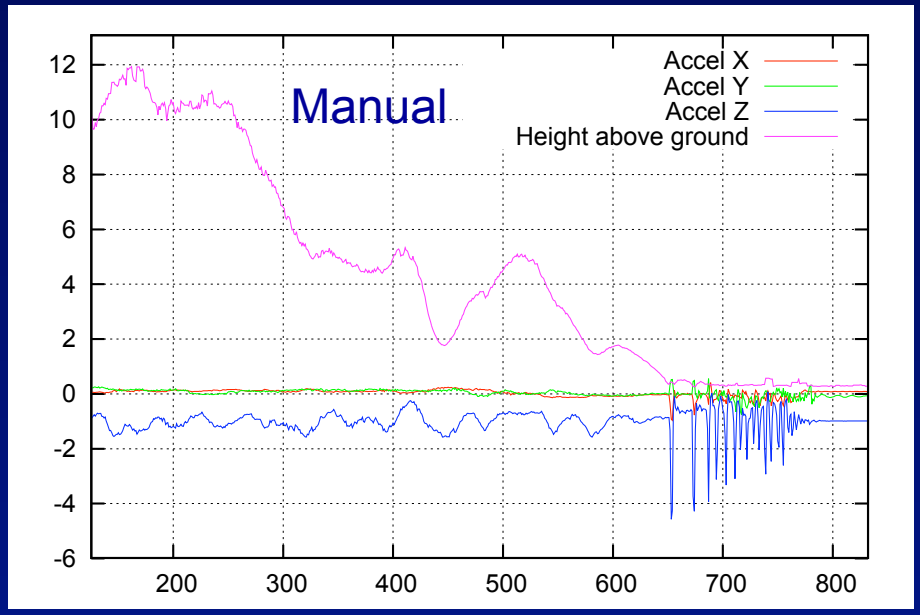
Thurrowgood, Soccol, Moore, Bland, Srinivasan (2011)

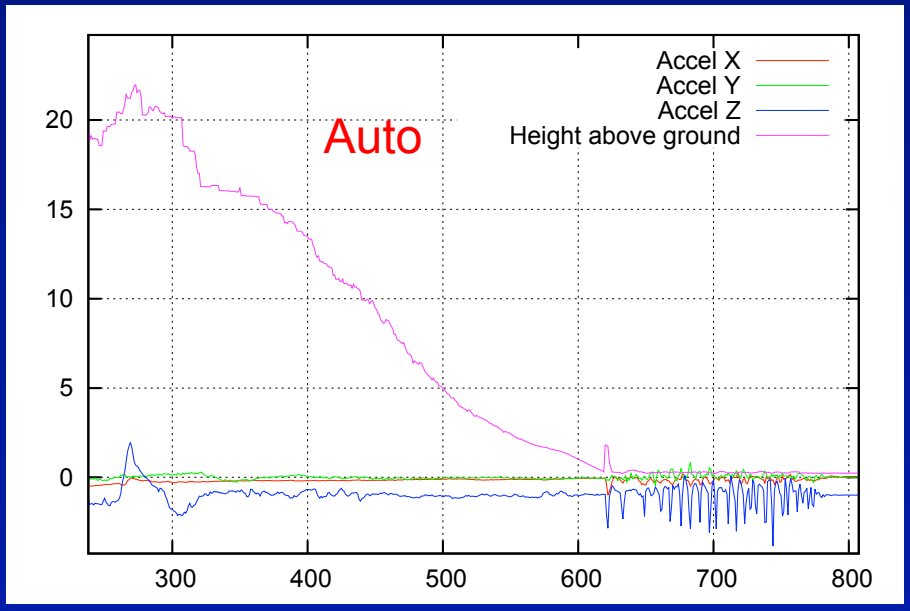
Automatic landing

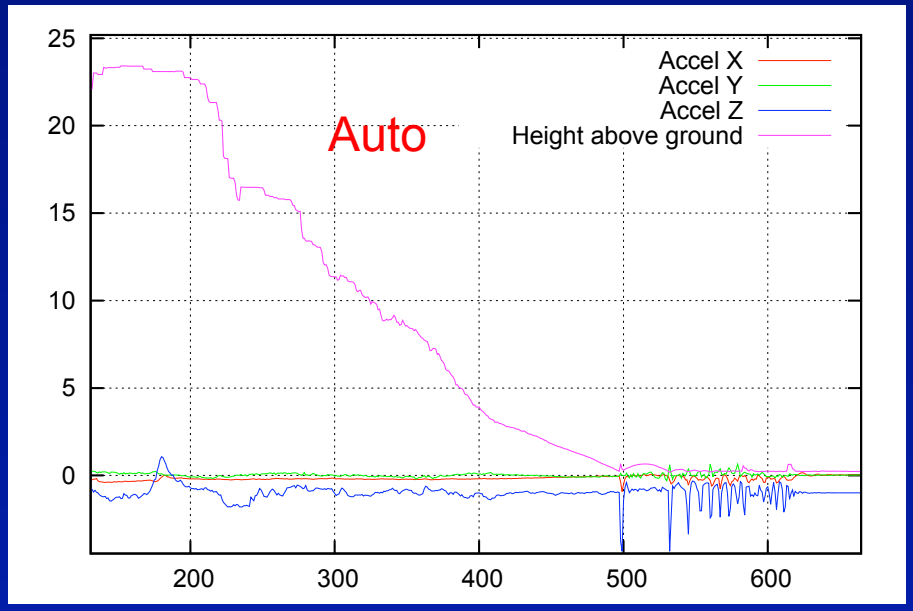
S. Thurrowgood, R.J.D. Moore,
D. Soccol, D. Bland and M.V. Srinivasan (in progress)

Automatic versus best manual landings: comparison









Sam Baker, Daniel Bland, Natalie Bland, Nikolai Liebsch,
Richard Moore, Gavin Taylor, Saul Thurrowgood, Dean Soccol