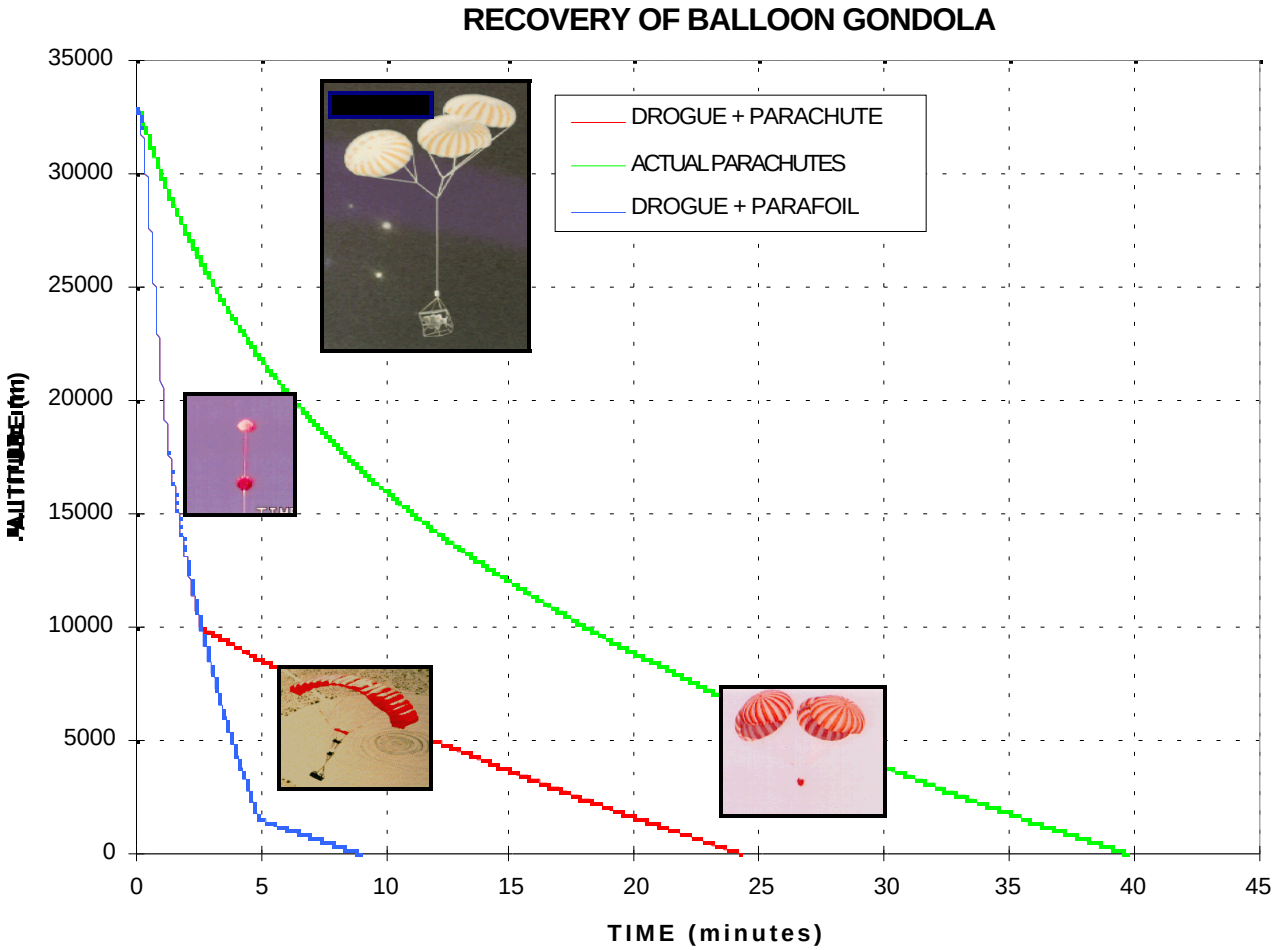
Flight Test Results of ORIONä

A. Vargas, J. Evrard
Centre National d'Etudes Spatiales (CNES) - France
Andre.Vargas@Cnes.Fr/+33-5-61-27-34-93
Jean.Evrard@Cnes.Fr/+33-5-61-27-47-26

Gondola Recovery Studies

- Wind drop sounding from gondola (telemetry relay) 1/2 hour before cut off :
  - **local wind relief/interaction**
- Drogue chute + conventional parachutes :
  - **high speed descent from ceiling to 1 000 m above ground**
  - **deployment and inflation of conventional parachutes (50 m/s)**
- Drogue parachute + parafoil - ORION™
  - **high speed descent from ceiling to 10 000 m above ground**
  - **deployment and inflation of parafoil (PIONNEER)**
  - **flight controlled by (AGU) Autonomous Guidance Unit (SSE) using GPS receiver, magnetic compass and pressure sensor**
  - **landing in a predetermined landing zone**

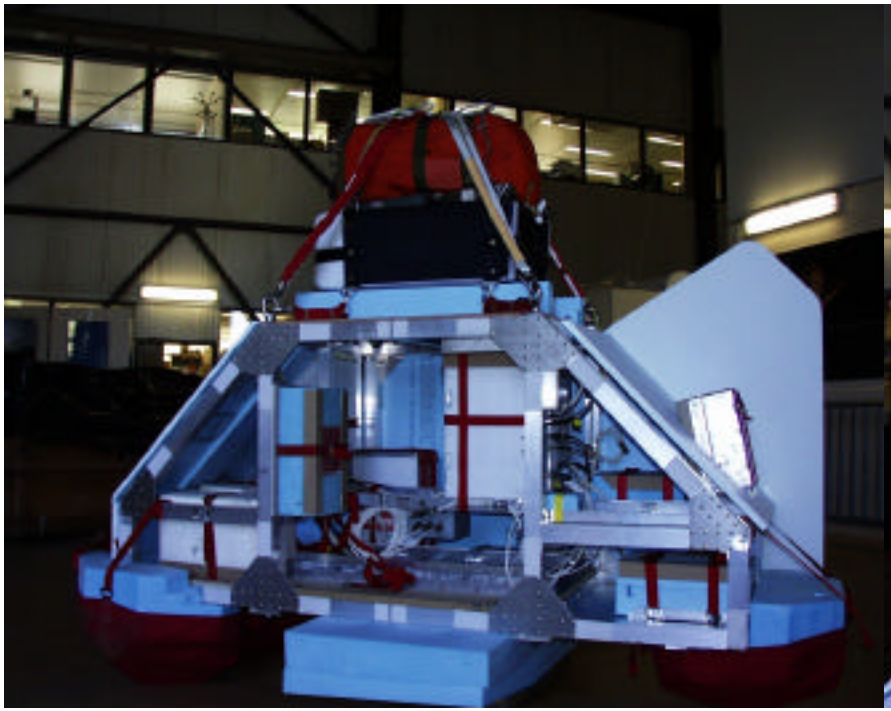
STATISTICAL RESULTS



Flight train & gondola configuration

- 20 m² chute drogue deployed in line
- packed parafoil of 70 m² (350 kg to 750 kg)
- parafoil and AGU tied on the gondola by tethers
- dedicated gondola (420 kg with ORION™)
  - command electronics to start ORION™ sequence (barometric sensors and remote control)
  - instrumentation : load cell in line, inertial unit, ….
  - real time video telemetry with 3 on board camera

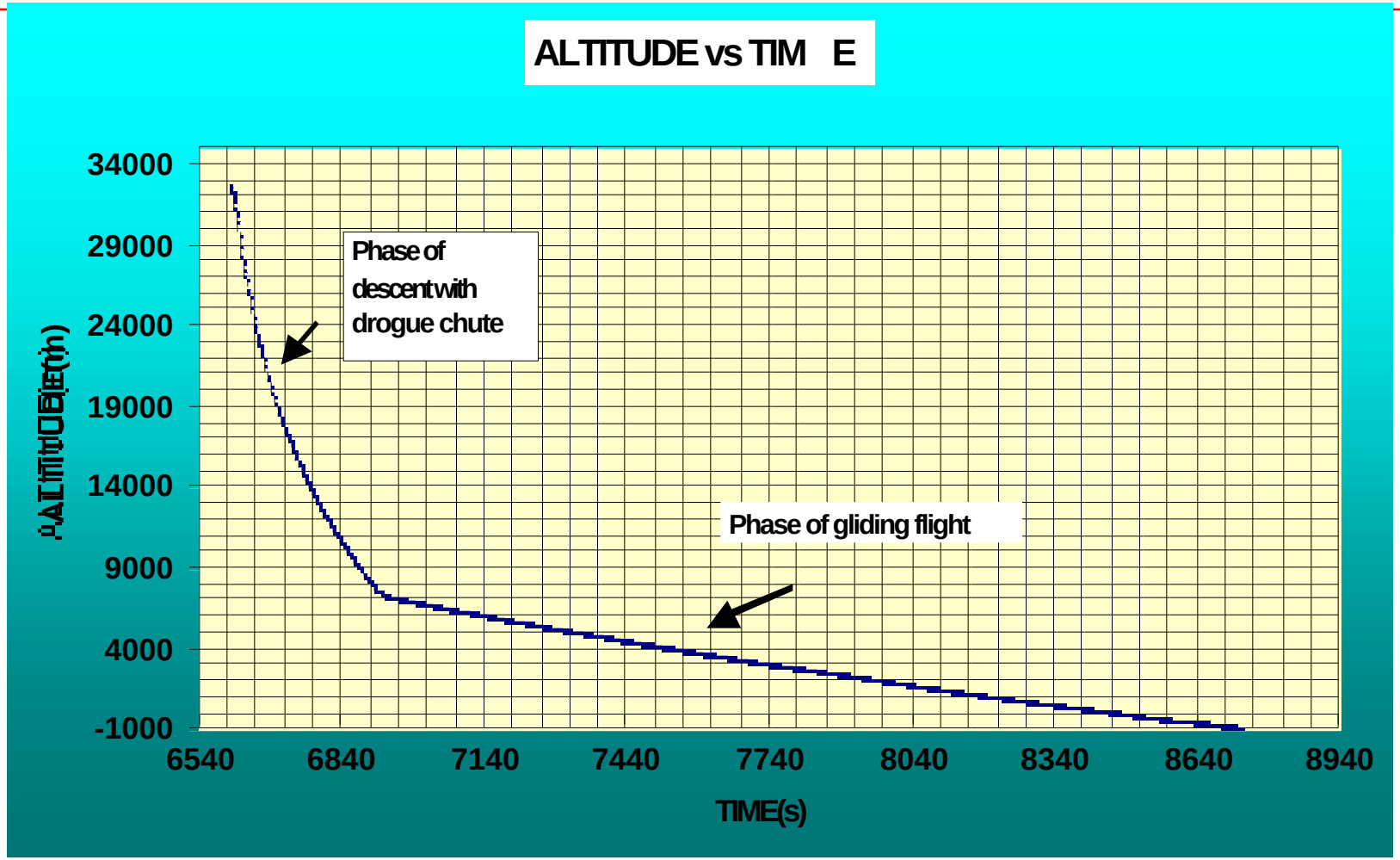
ORION™ dedicated gondola



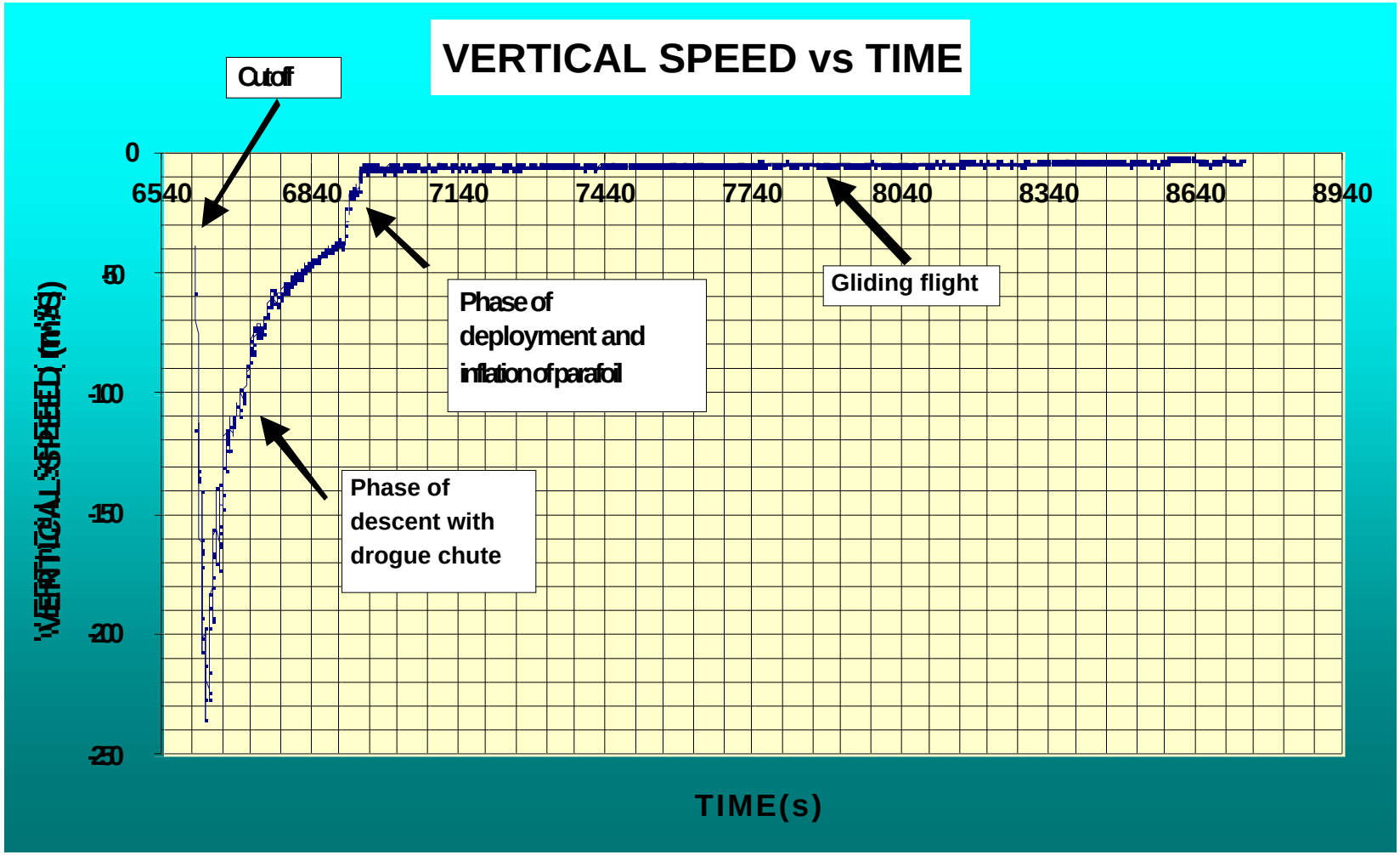
Scheme of Flight Test

- ascent of stratospheric balloon up to a 33 km ceiling
- after balloon cut off, quick descent (up to 150 m/s) using in line drogue chute
- at 10 km, deployment of AGU with packed parafoil. After that, deployment and inflation of parafoil (3 stages of reefing)
- autonomous gliding flight (operated by AGU) to reach a landing area 20 km away

ORION™ flight test results



ORION™ flight test results

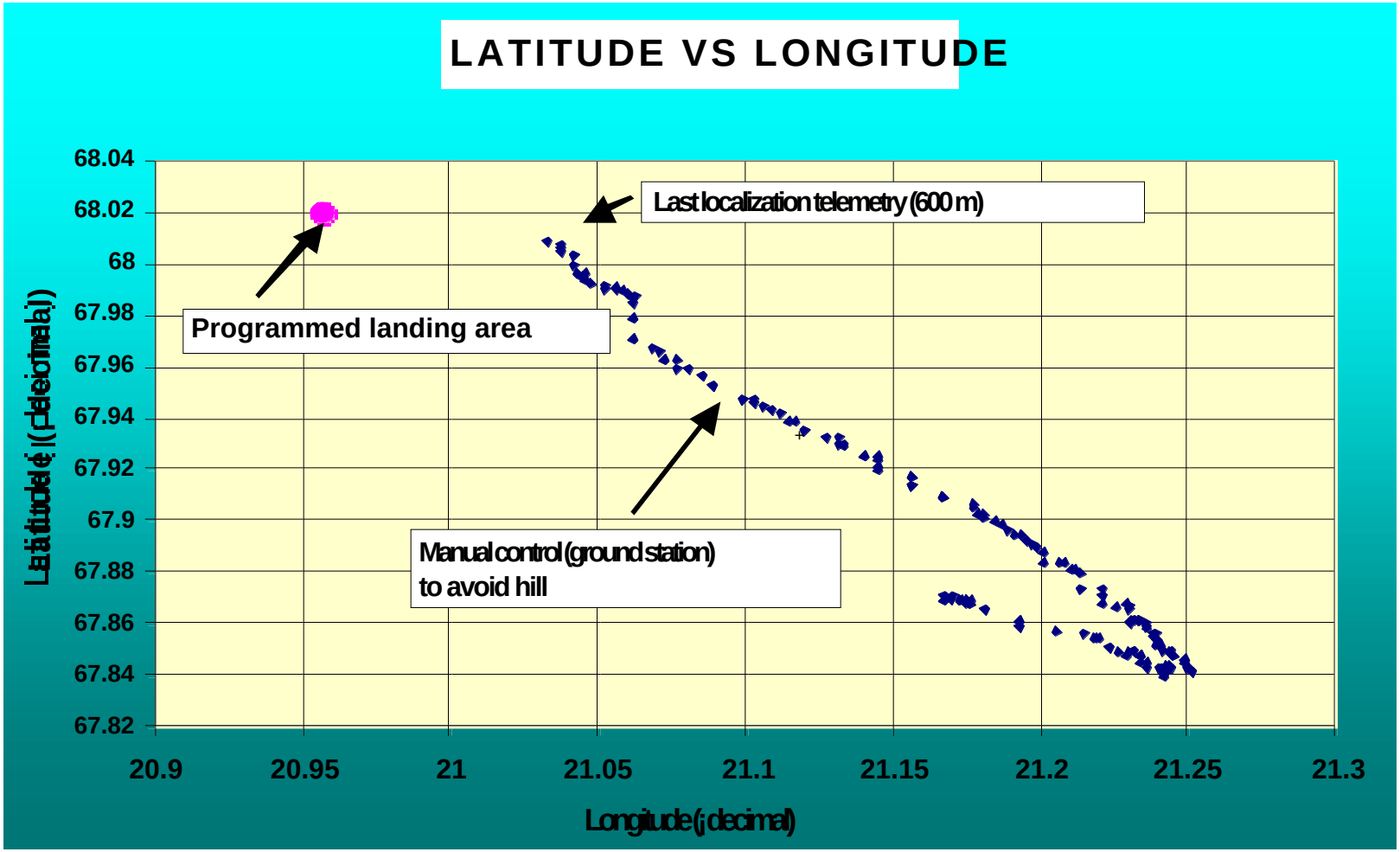


ORION™ flight test results

LOAD vs TIME

(see accompanying chart “13reco-3.ppt”)

ORION™ flight test results



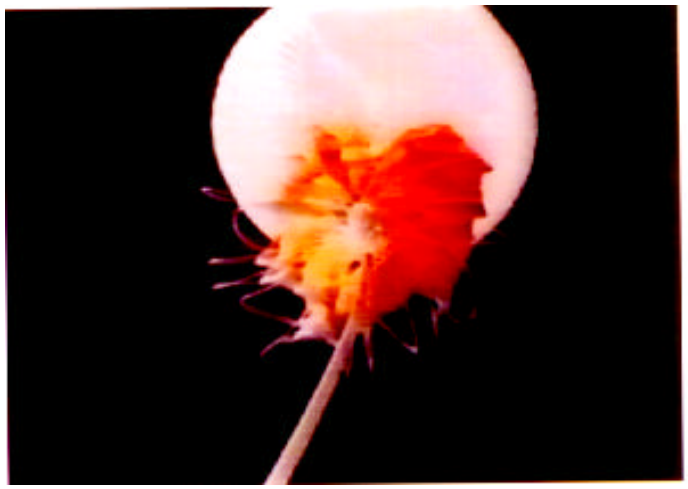
ORION™ flight test results

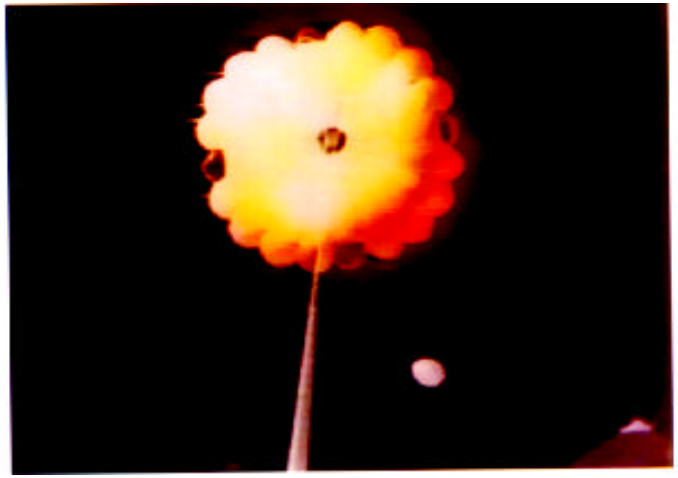
- the flight test was successfully performed in Kiruna/Sweden last summer (August, the15)
- ORION™ balloon configuration and drogue mechanical behaviour validated
- 30’ of autonomous flight performed
- 2 main anomalies detected :
  - great instability just after parafoil inflation
  - the first 4’ of flight with AGU not operating : drift with the wind - opposite direction of target area for landing

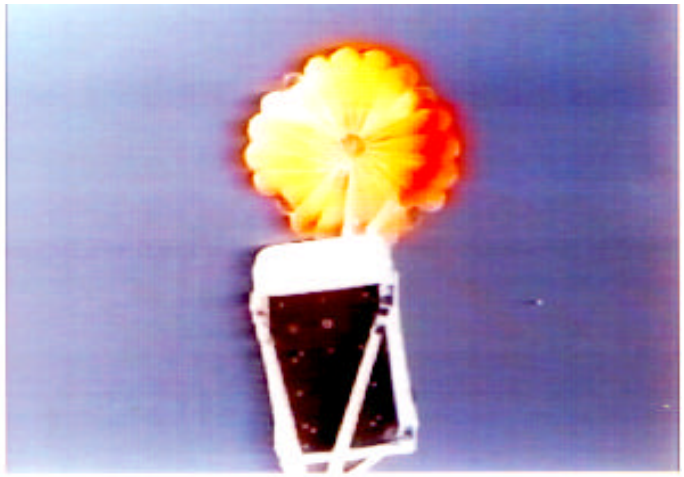
Future plans

- achievement of flight results analysis :
  - instability just after parafoil inflation ?
  - hazardous behaviour of AGU during 4 ' ?
- configuration evolution :
  - increase of drogue size (35 m^2) to secure parafoil inflation
  - drogue packaging into deployment bag
  - capability to modify mission (injection & target spots) by telemetry during balloon flight
  - integration of emergency system with conventional parachutes to avoid gliding (if control problem)
- next flight test in Kiruna on February 99

Parachute drogue descent







Parafoil opening and flight