SolarPACES

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within IEA SolarPACES on

"Solar Technology and Applications"

Kibbutz Shefayim, Israel

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IEA-Solar Power and Chemical Energy Systems
Task III: Solar Technology and Applications

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IEA SolarPACES Task III Working Group Meeting
Kibbutz Shefayim, Israel, July 3rd 1999

First autonomous heliostat (Project status)

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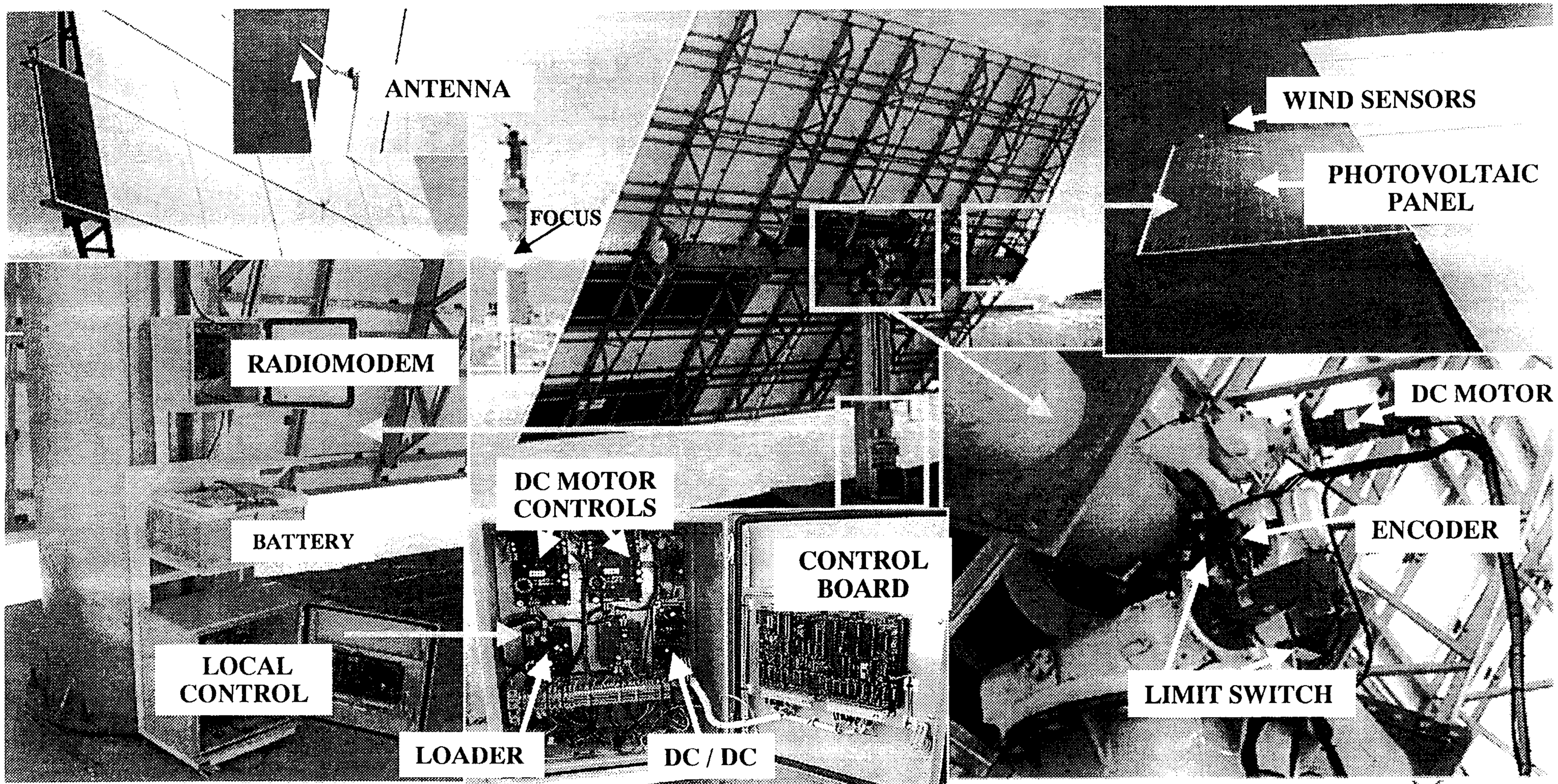
Stand-Alone Heliostat

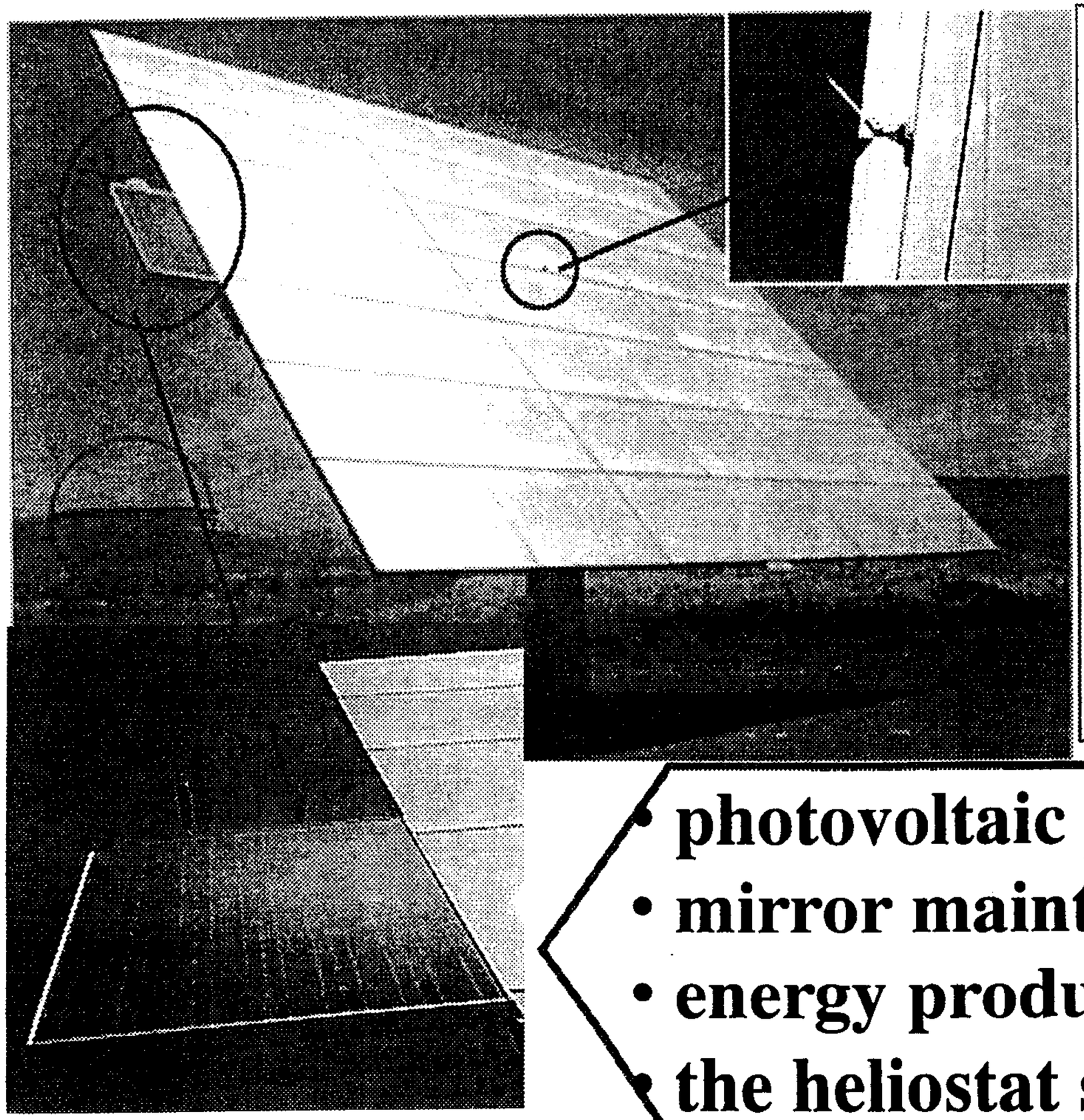
THE NEW!

- **PSA, with UALM collaboration, has designed a first Stand-Alone Heliostat**
- **Since April the stand-alone heliostat is continuously working at the PSA**
- **One 70m², "T" classical glass-metal heliostat has been adapted to include all the stand-alone concepts**
- **It's working without wires&channels**
- **It can operate in cloudy days**
- **It knows the weather conditions for auto-protection**

Stand-Alone Heliostat



Stand-Alone Heliostat

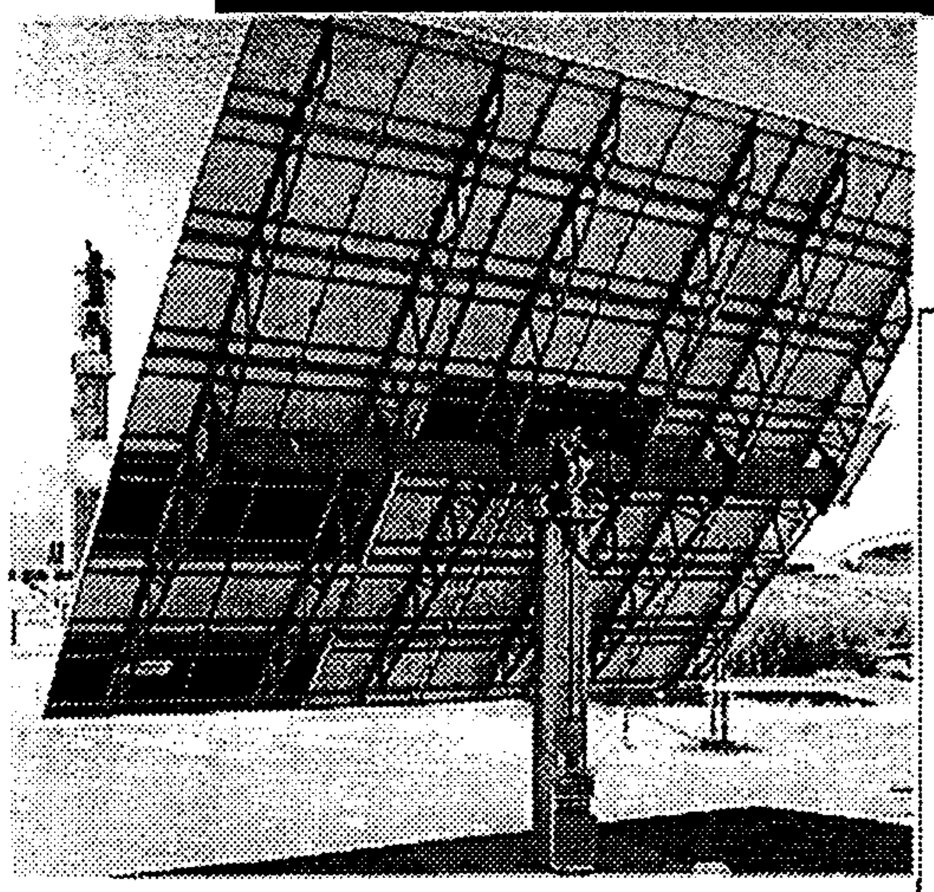


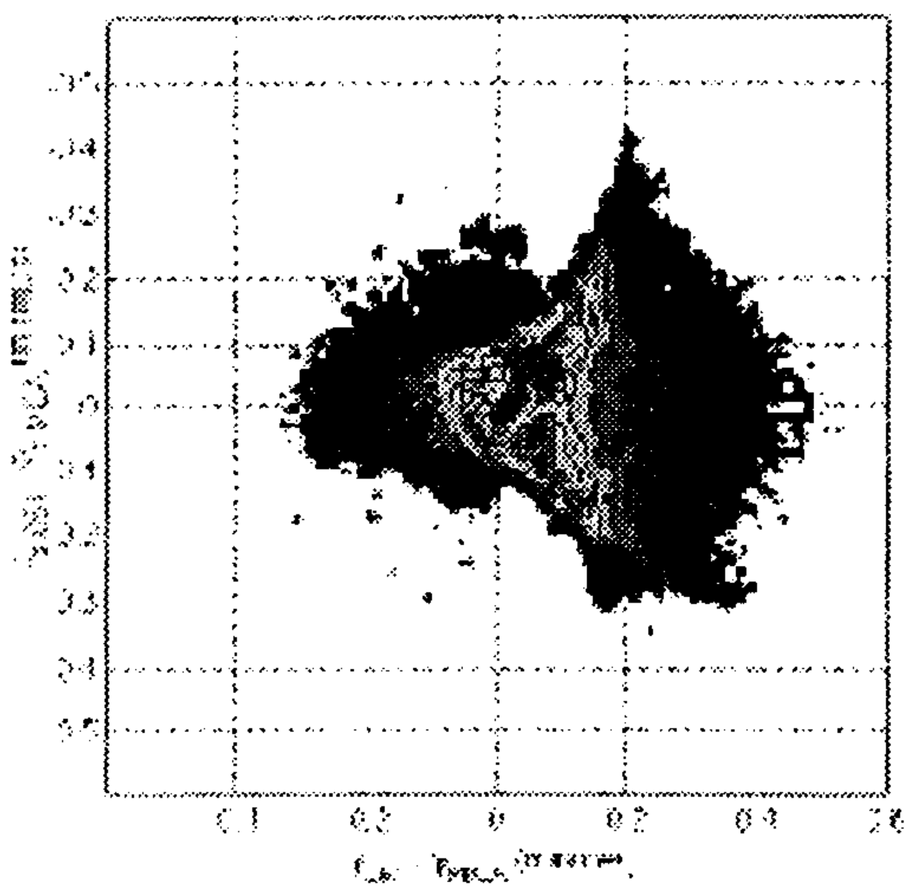
STAND-ALONE CONCEPTS

- **To know real time and calendar**
- **Solar vector and axis position calculat.**
- **Photovoltaic energy to work**
- **Radio communications**
- **It can decide security actions (auto-protection)**
- **Powerful diagnosis**

- **photovoltaic panel located in the same facets plane**
- **mirror maintenance permits optimal panel condition**
- **energy productions in the same consumption time**
- **the heliostat solar tracking ⇑ the energy produced**

Stand-Alone Heliostat





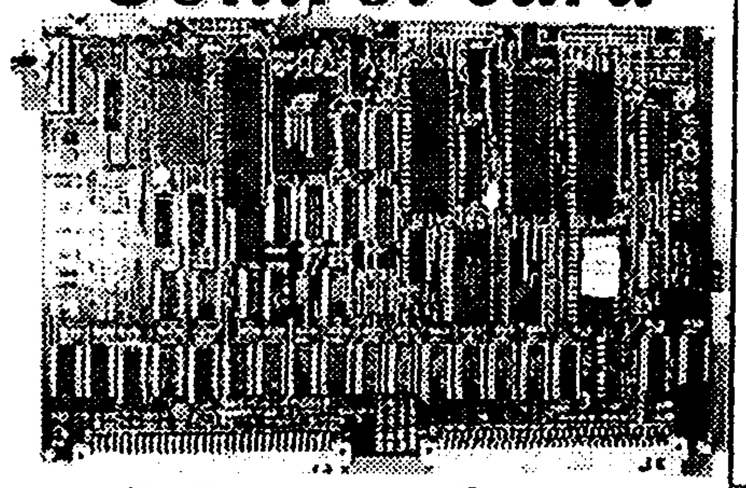
- Classical **"T" glass-metal** heliostat of 70m^2
- Located at 383m of the CESA1 Tower

• Motors:	24Vdc, 10A, 3000rpm
• Geardrives ratio:	28000 / 1 azimuth&elevation
• Speed axis:	High: 7.2ºmin & Low: 2º min
• Encoders:	incremental type 3600x4 (14400bits
• Angular resolution:	0.025º in each axe
• Photovoltaic panel:	polySi, 24Vdc, 110Wp
• Battery:	2x12Vdc, 55AH
• Radiomodem:	400-470Mhz, messages encrypted 9600baud, a lot frequencies
• Wind sensor:	special magnetic switch
• Additional sensors:	anemometer, PT100, piranometer
• Solar vector calc.:	PSA hybrid algorithm, error<0,5min

Stand-Alone Heliostat

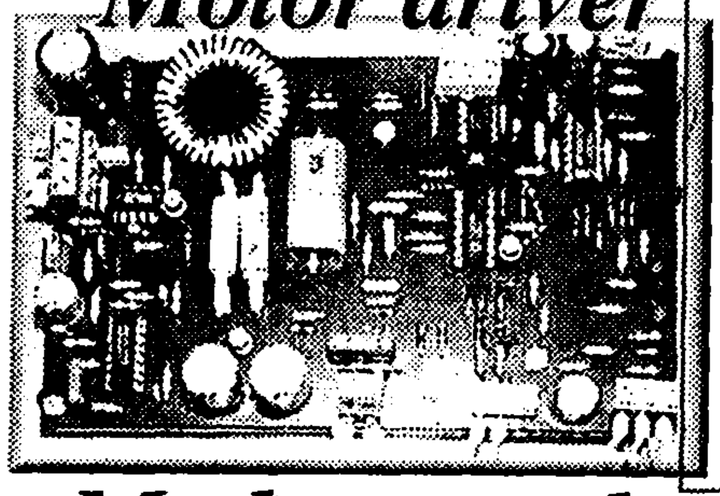
NEW ELECTRONIC CARDS DEVELOPMENT

Control card



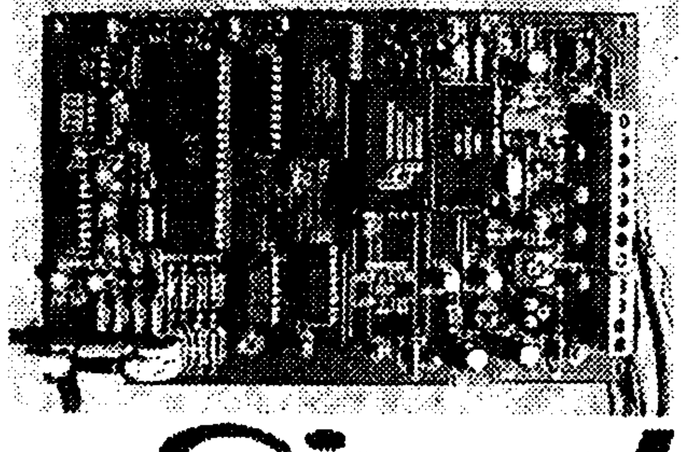
- Solar vector calculation using a hybrid PSA algorithm
- Microcontroller with real time clock and calendar
- Reading of two optical increm/abs encoders until 65536 bits
- Reading of eight analog. signal (wind, consumption, temp..

Motor driver



- High efficiently & low noise control DC motor speed(>90%)
- DC Motors between 5 to 24Vdc, 0 to 15A
- Several adjustable speeds and right and left directions
- Overload and short-circuit protection

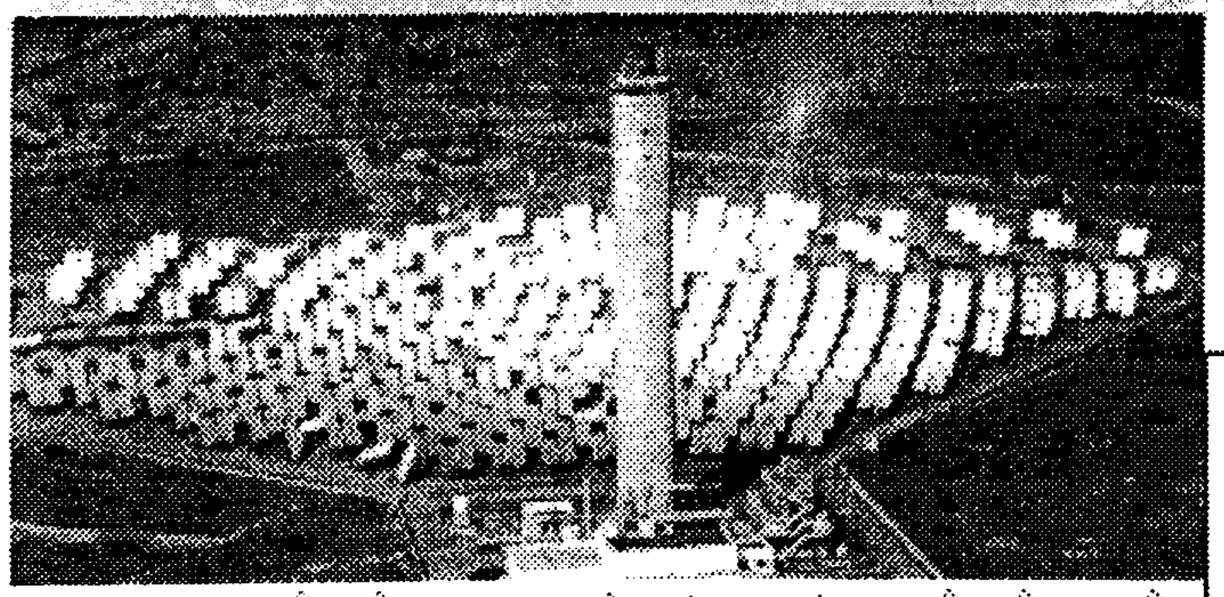
Modem card

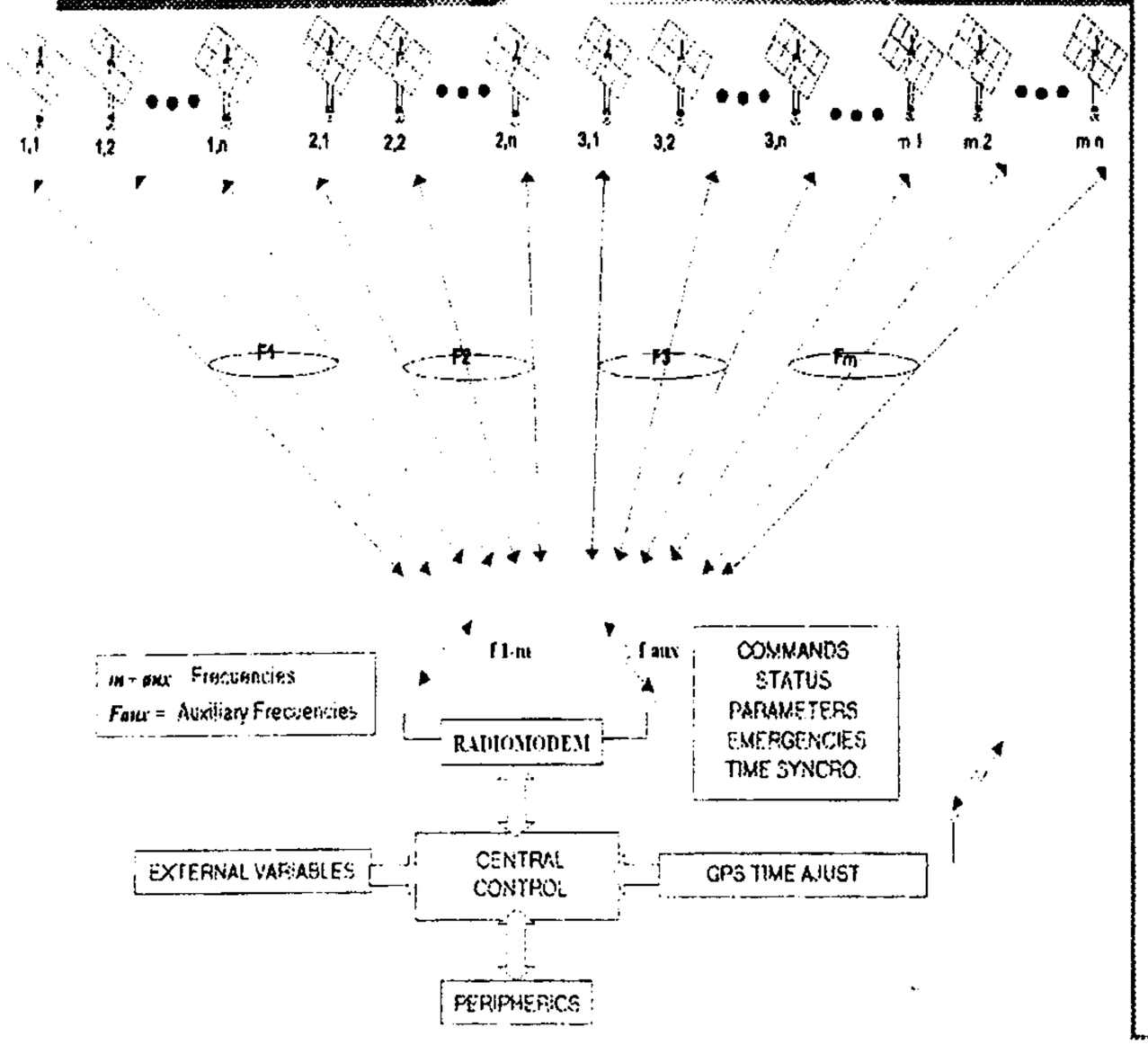


- An advanced radiomodem is controlled by microcontroller
- 400-470MHz band and 9600bauds
- Messages are identified and encrypted with time codes
- It can switch 255 radio channels on different frequencies

Ciemat

Stand-Alone Heliostat





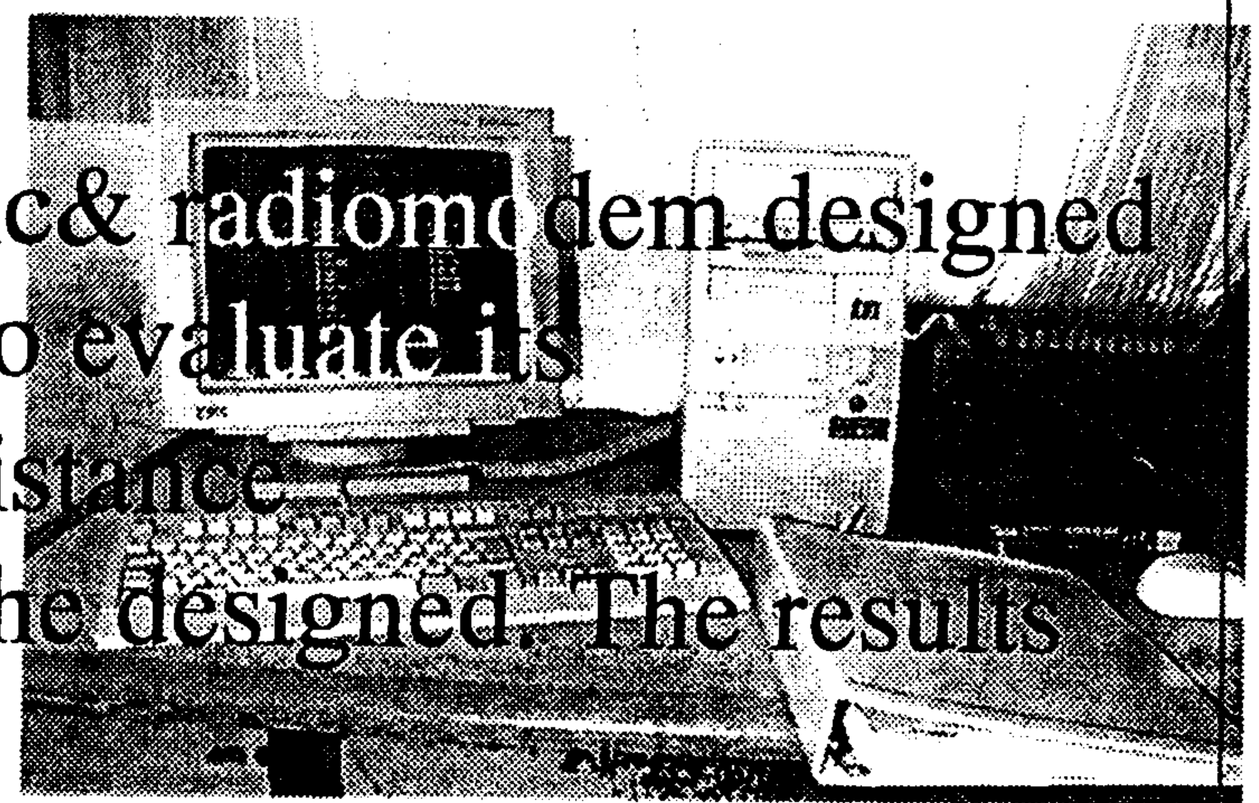
Stand-Alone Heliostats Field Advantages

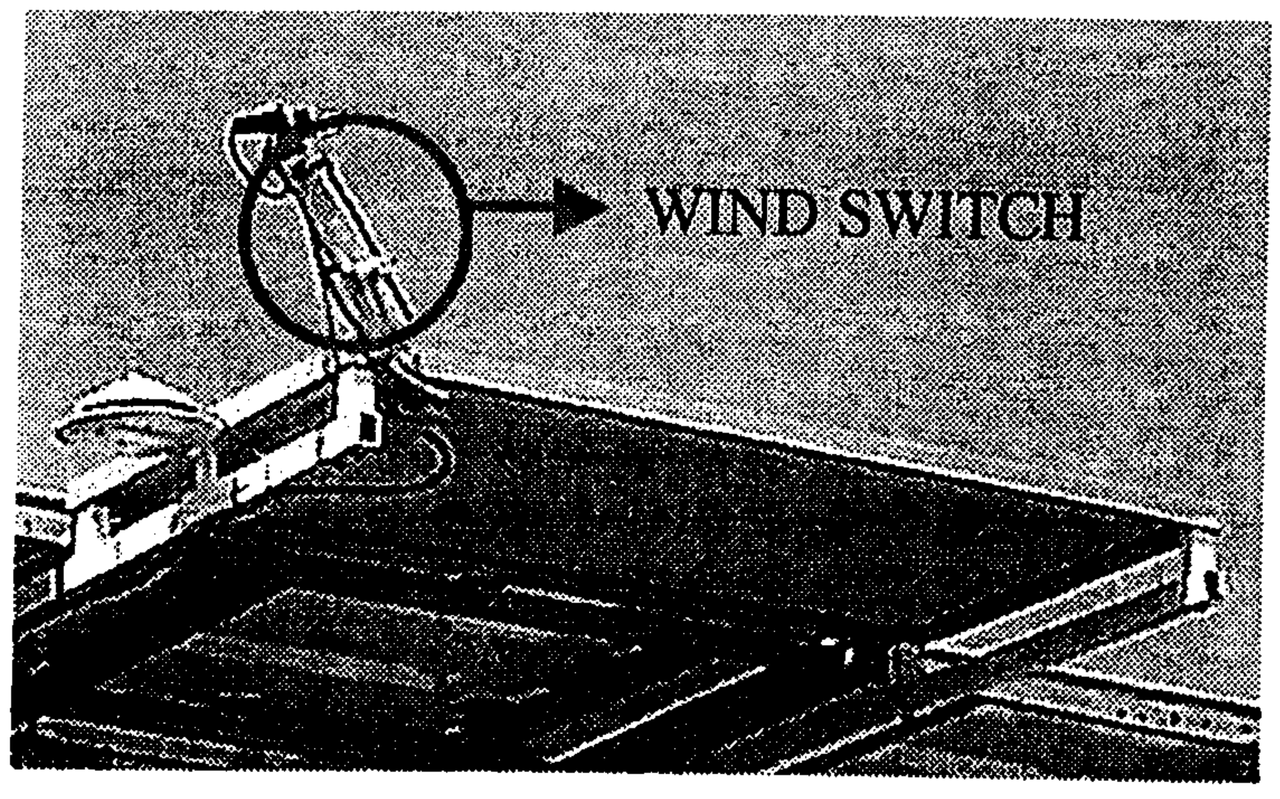
- Very low Infrastructures costs (wires, channels, electrical distribution and protection elements, UPS,…)
- Immunity of lightning damages
- Each heliostat has an Uninterrupted Power Unit and it'll not depend of conventional power supply
- These will use incremental encoders (cheaper) with the absolutes advantages (don't loose references)
- The field will continue in operation when software o electric cracks situations happen
- The new heliostat ampliations are very easy

Stand-Alone Heliostat

TEST CAMPAING

- We are going to check the preliminary photovoltaic& radiomodem designed
- We will get a data base from the electronic cards to evaluate its
- During August the heliostat will work without assistance
- In September we will have enough data to adjust the designed. The results will be published in October





PRELIMINARY COSTS

• Photovoltaic: about 1 Wp / m^2	5 $/m^2
• Battery and loader:	2 $/m^2
• Radiomodem and antenna:	350 $
• Wind switch:	10 $
Total for 70m² heliostat:	***850 $***

Stand-Alone Heliostat

Heliostat tests chronogram

Id	Nombre de tarea
1	PHASE I
2	Measurement procedure assess.
3	Tests A/D lab-scale
4	Assembly hardware new chips
5	Installing wind sensors
6	Routine software read A/D
7	Routine software data processing
8	Tests
9	
10	PHASE II
11	Functional tests
12	Tests communications
13	Routine operation (data acquisition)
14	Determination autonomy
15	Emergency situations
16	Cyclic autonomous operation (data acquisition)
17	Data analysis
18	Publication and dissemination
19	
20	PHASE III
21	Optimization hardware assess.
22	Cost analysis
23	Publication and dissemination
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