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Avion à géométrie variable

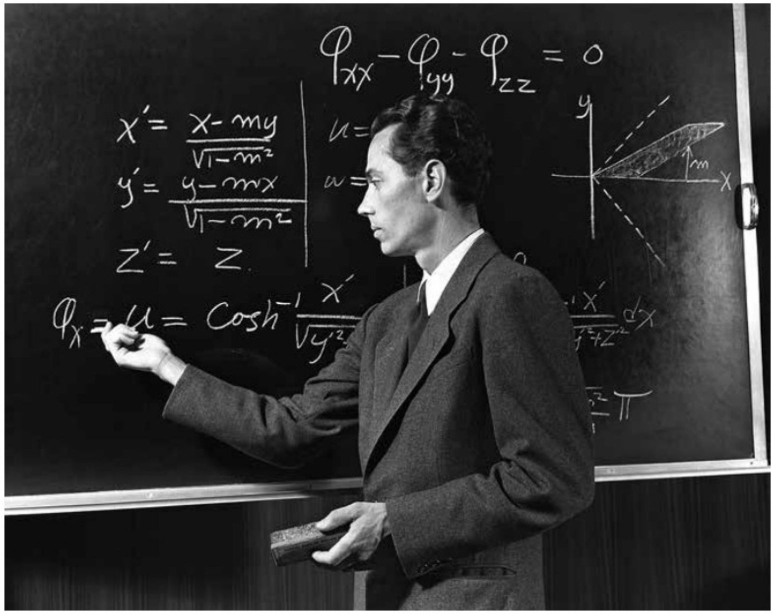
Thinking obliquely, NASA

Quel angle choisir pour avoir la plus faible consommation à une vitesse donnée ?

I – Dispositif expérimental
- Réalisation
- Résultat

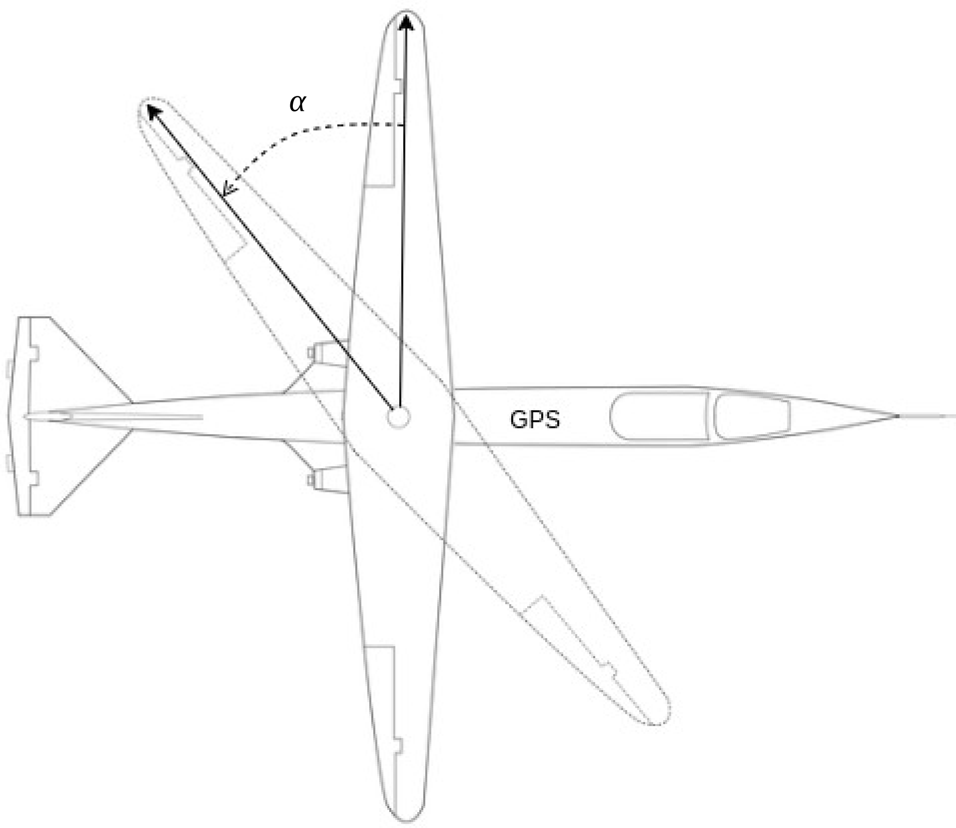
II - Théorie

III - Conclusion



Thinking obliquely, NASA

Dispositif expérimental



Protocole :

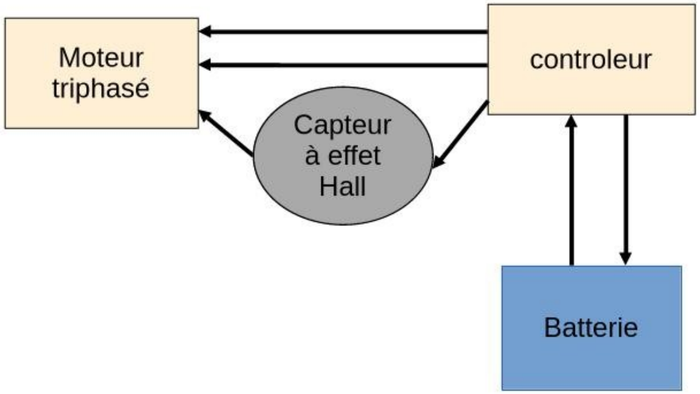
→ Mesurer les données requises :
- Vitesse
- Puissance des moteurs
- Angle de l’aile

→ Vols avec des angles et vitesses différents

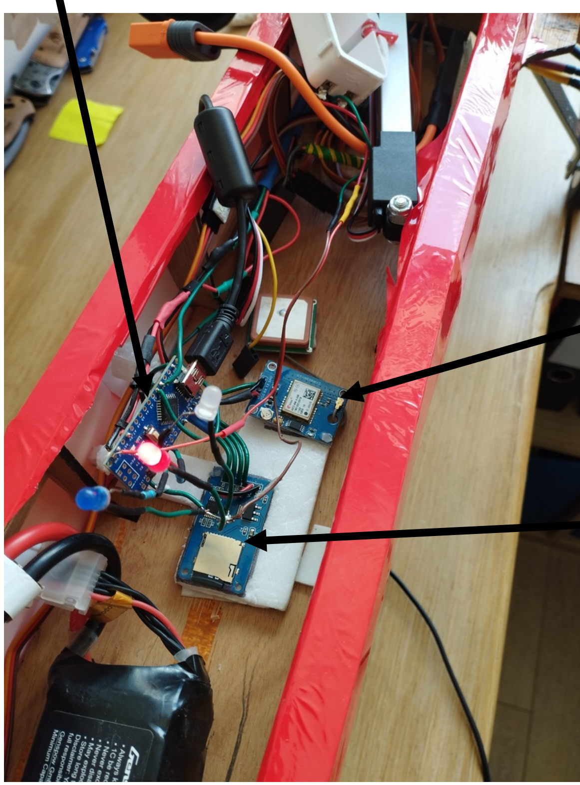
Relation entre l'angle et la commande d'entrée :

$$\alpha = \arcsin\left(\frac{d - k \cdot x}{r}\right)$$

$$\alpha = \arcsin(17 - 0.04\,x)$$



Carte Arduino

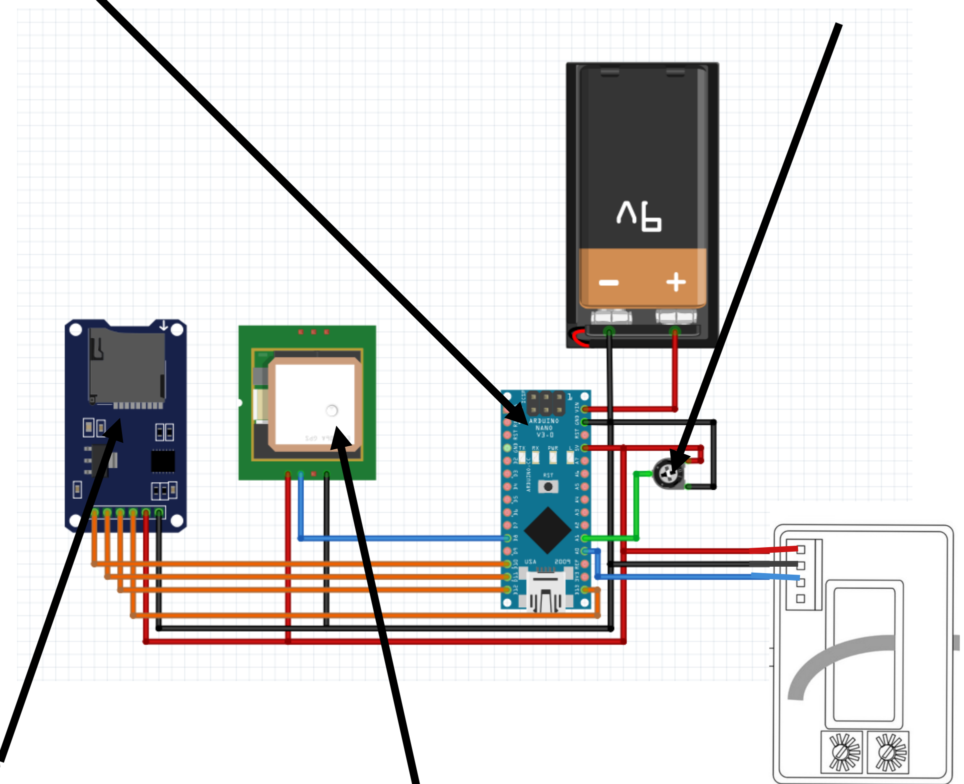


GPS

Module Carte Sd

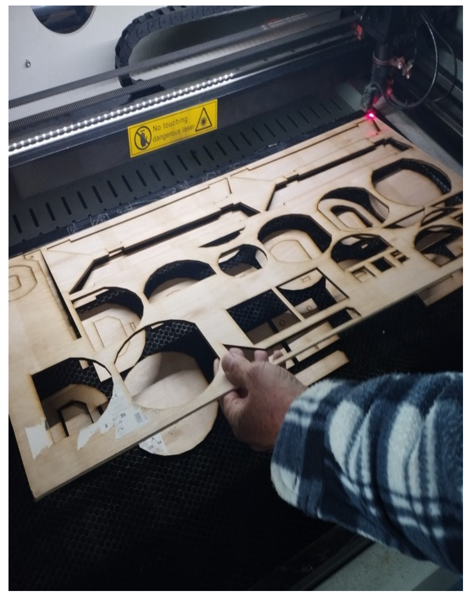
Carte Arduino

Potentiomètre



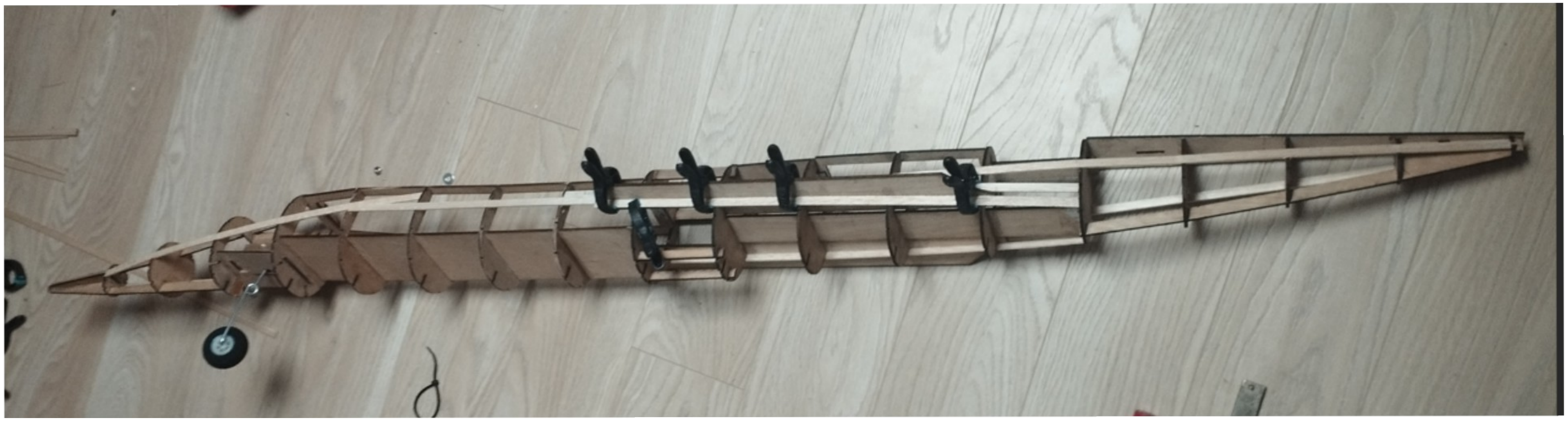
GPS

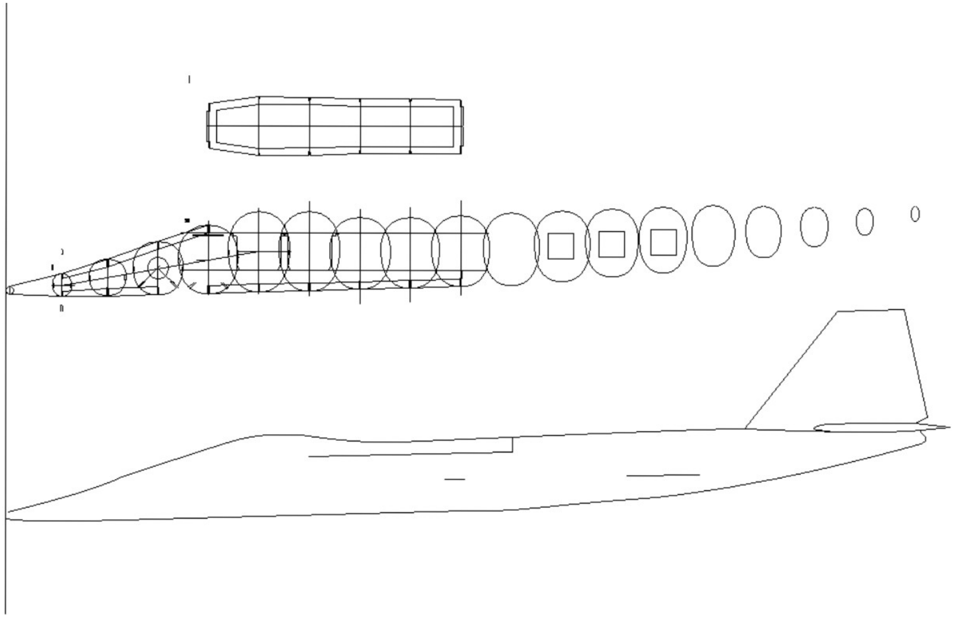
Réalisation de l’avion

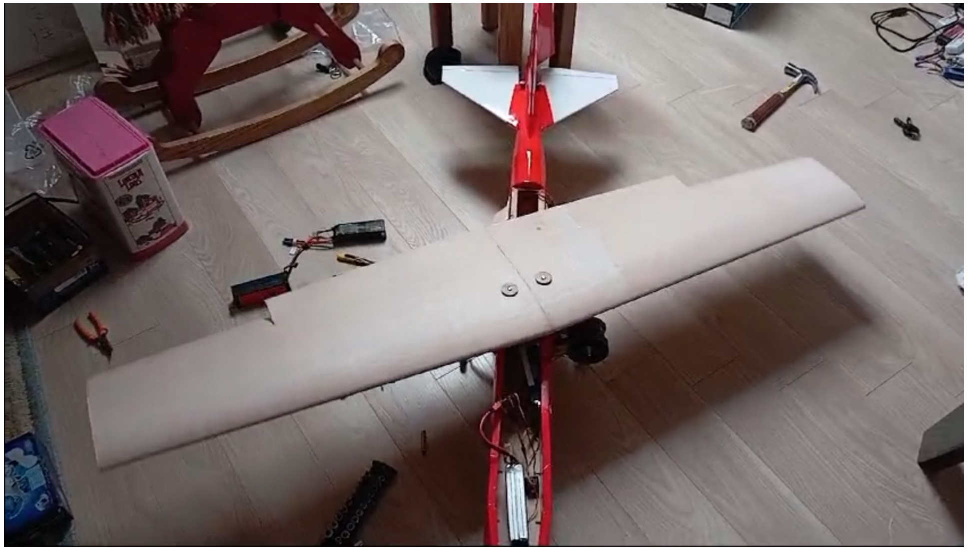


Envergure : 1m70
Longueur : 1m86
Echelle : 1/5

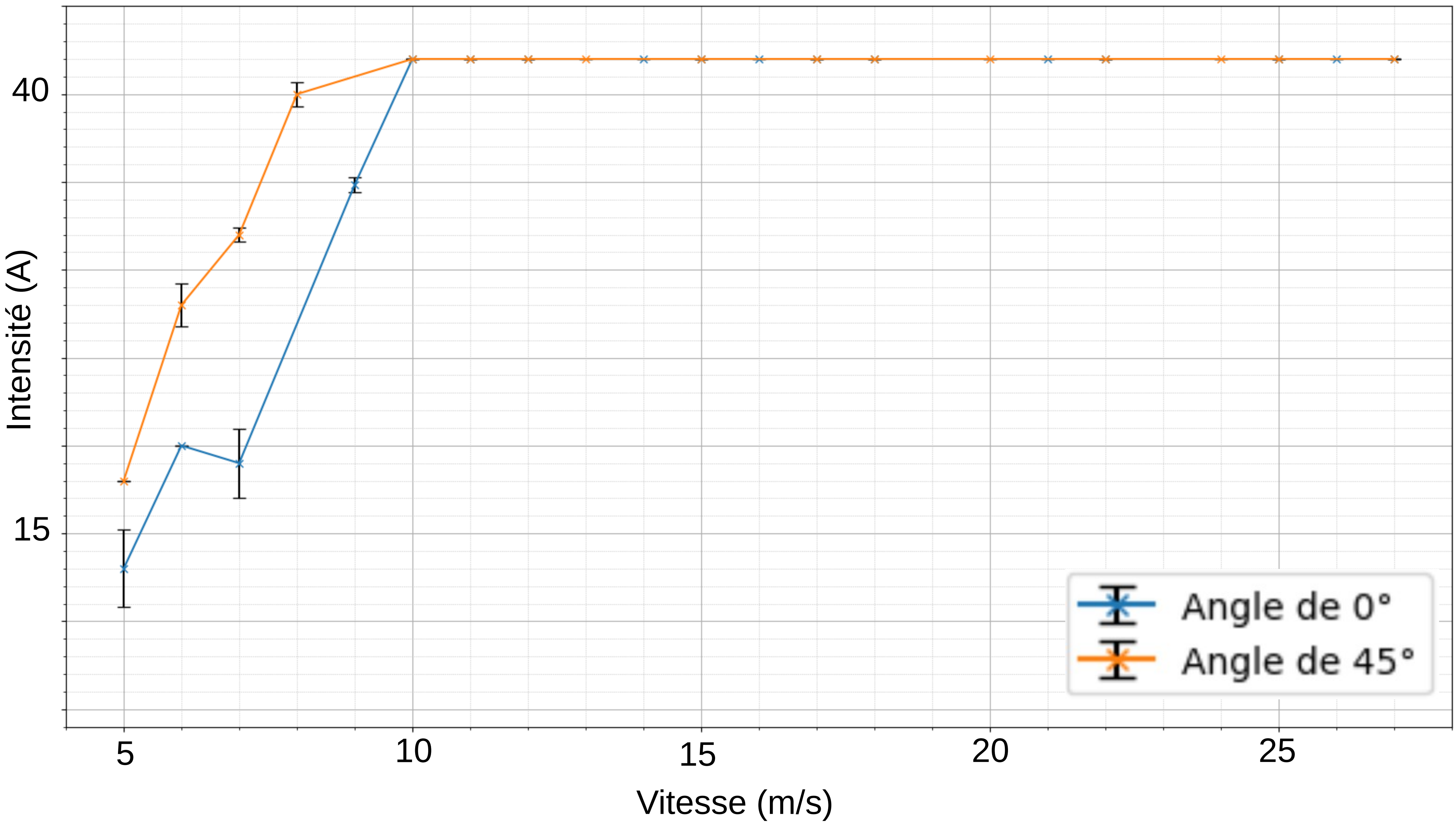
2e dispositif expérimental



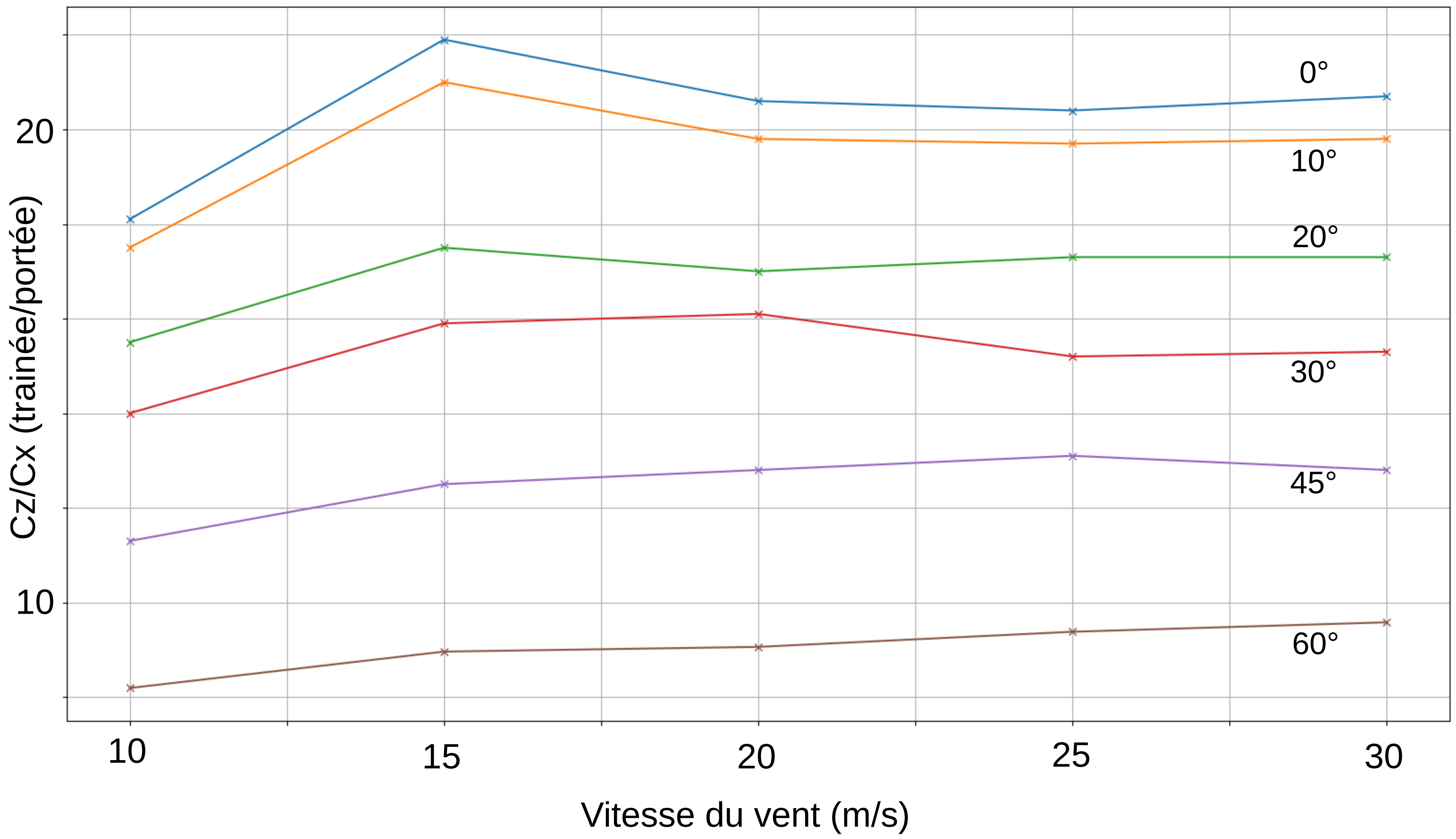




Résulats expérimentaux



Analyse théorique



Conclusion

Annexe

Critère de Nyquist-Shannon

$$f_{ech} > 2 f_{max} \simeq 16\,KHz$$

$$f_{ech,max} = 115200\,bauds = 14{,}4\,kHz$$

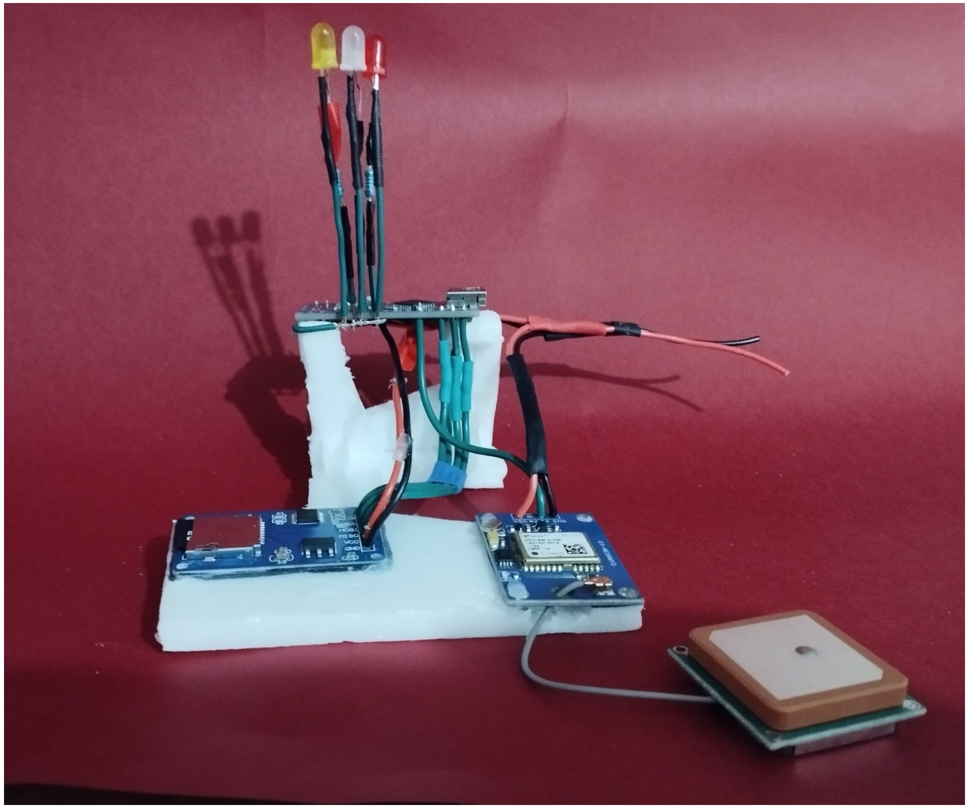
Critère presque respecté

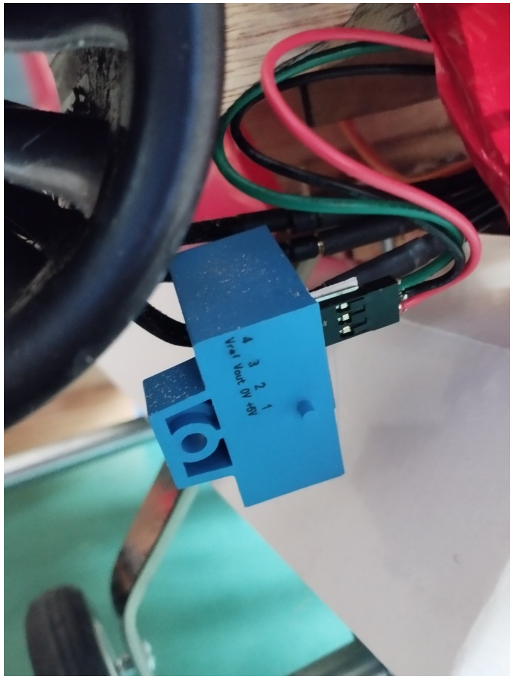
YHDC®

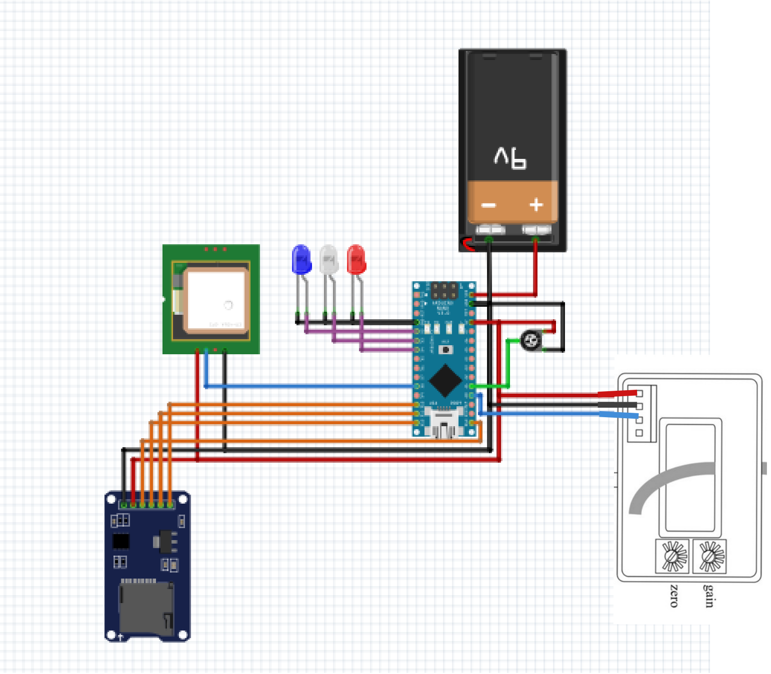
Electrical parameters: (The following parameters are typical values and actual values will be subject to product testing)

Remarks:

I_{PN}	Rated input	±50A	±100A	±200A	±300A	±400A	±500A	±600A	Standard input
Ipm	Input measurement range	±75A	±150A	±300A	±450A	±600A	±750A	±900A	The default is 1.5 times the rated input
Vout	Rated output	2. 5V±0. 625V							Standard output
X	Accuracy	1%							$I=I_{PN}$
εL	Linearity	1%							$I=0\tilde{}\pm I_{PN}$
Vc	Supply voltage	+5V							Supply voltage range±5%
Ic	Current consumption	⩽15mA							Reference will be subject to the measured
Rl	Load impedance	⩾10KΩ							Collection port impedance while lower voltage affect accuracy
Voe	Zero offset voltage	⩽±15mV							TA=25℃
Tr	Response time	⩽3μs							Reference will be subject to the measured
N.w	Weight	60g							Reference will be subject to the measured
Ta	Operation temperature	-10～+70℃							
Ts	Storage temperature	-25～+70℃							
Bw	Band width	DC˜50KHz							Factory test according to DC
Vd	Delectric strength	3KV 50Hz 1min							

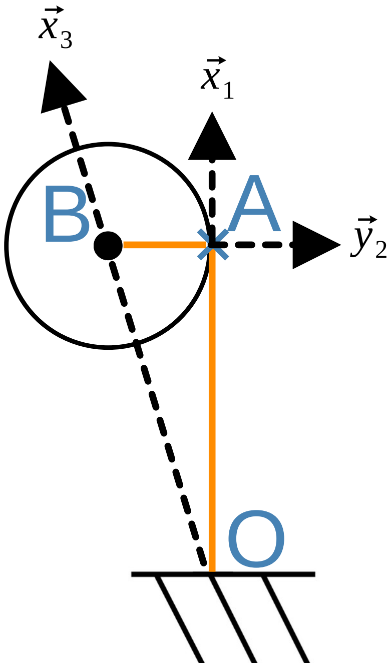


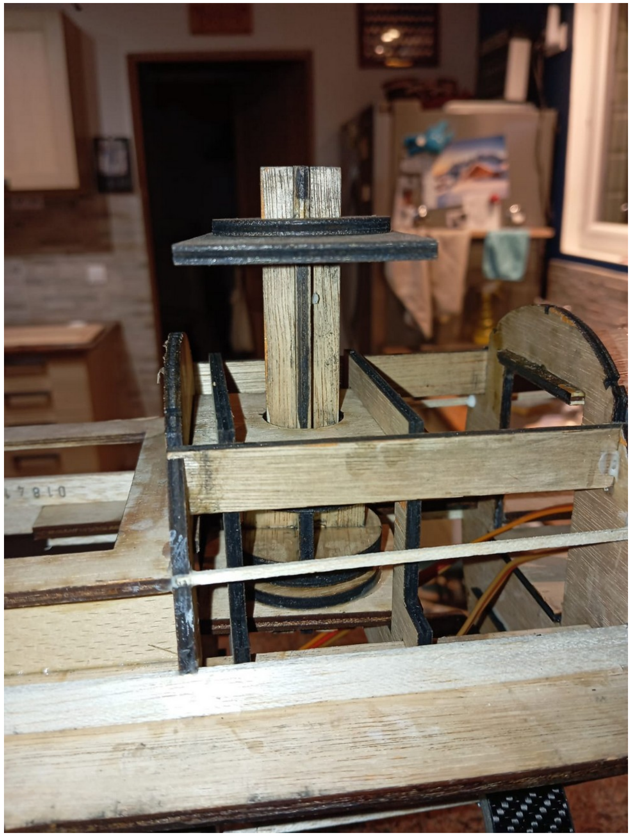



9V
−
+
zero
gain

$$\begin{cases} \alpha = (\vec{x}_1, \vec{x}_2) = (\vec{y}_1, \vec{y}_2) \\ \theta = (\vec{y}_1, \vec{y}_3) = (\vec{y}_1, \vec{y}_3) \end{cases}$$

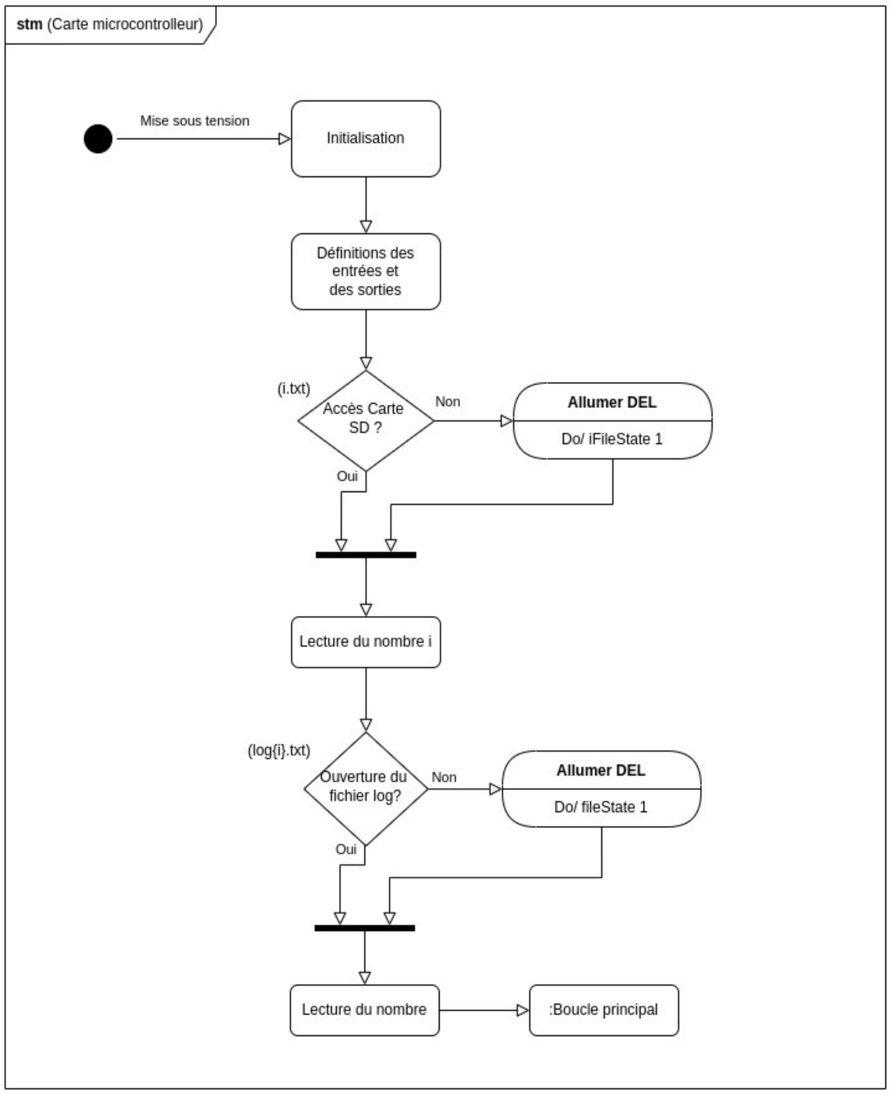
$$\begin{aligned} \overrightarrow{OA} &= \lambda\, \vec{x}_1 \\ \overrightarrow{AB} &= -r\, \vec{y}_2 \\ \overrightarrow{OB} &= d\, \vec{y}_3 \end{aligned}$$

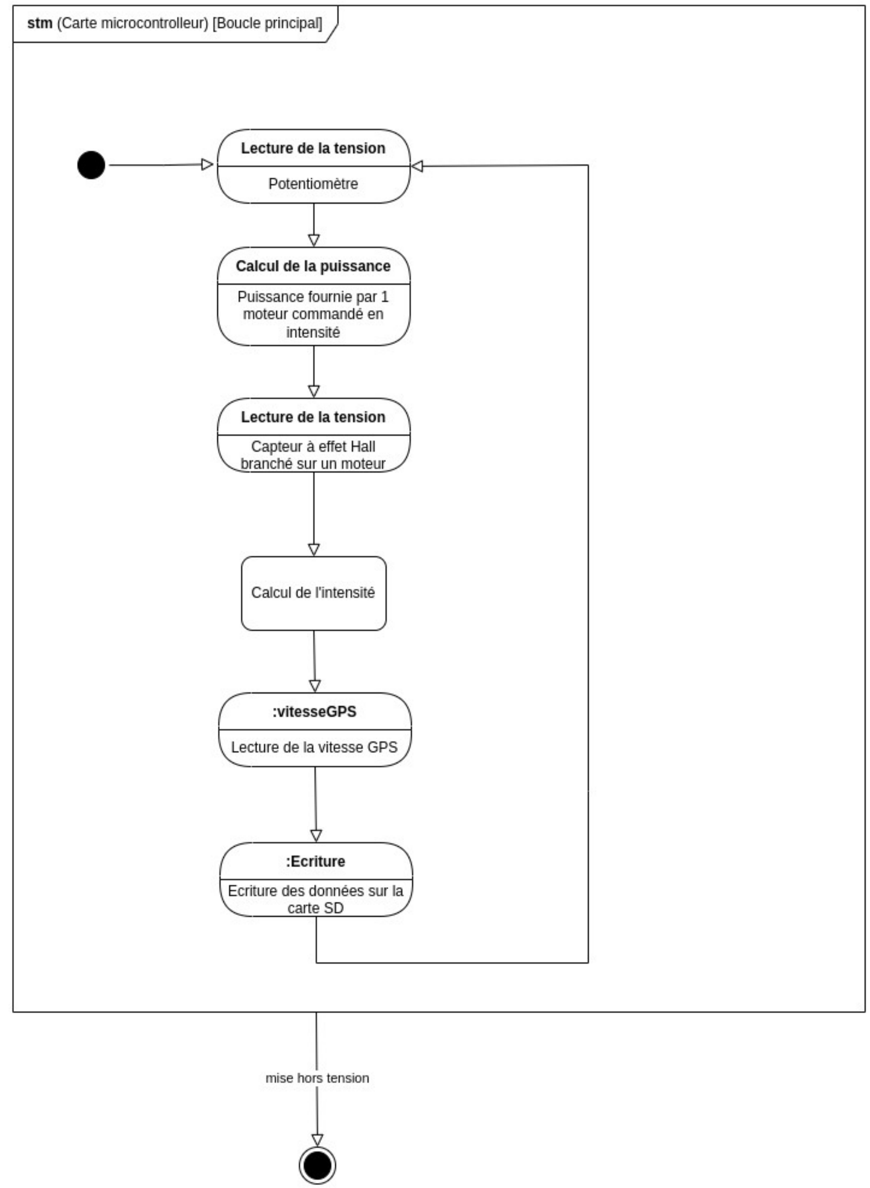


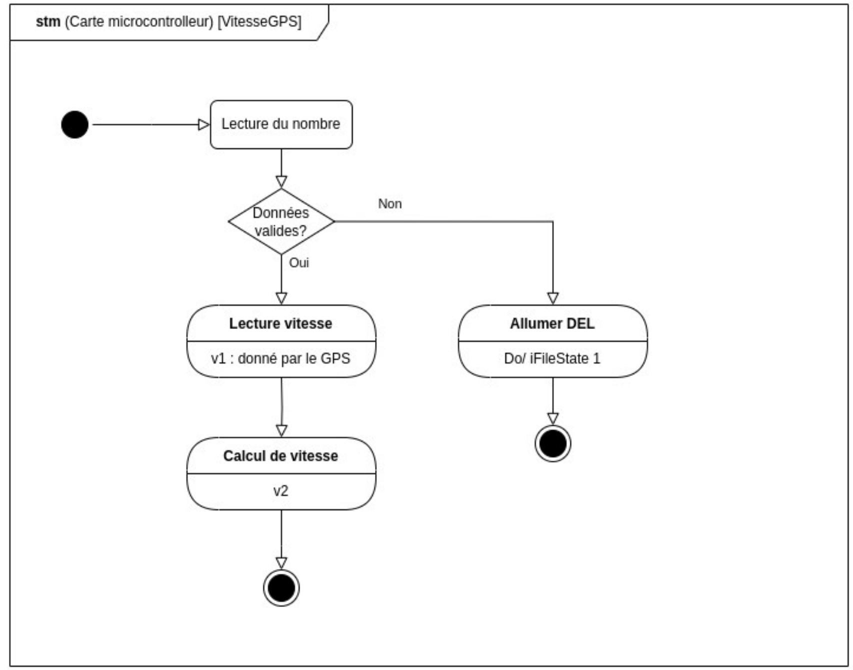


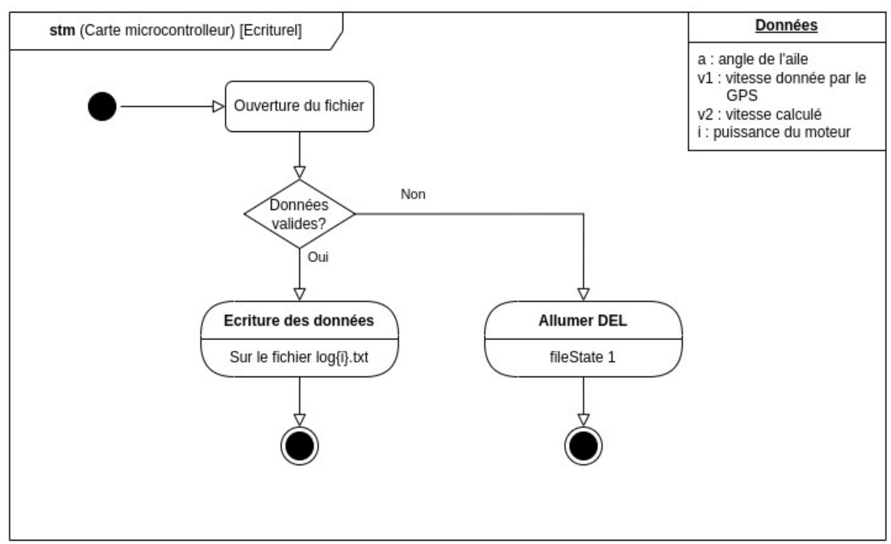
$$\begin{aligned} x &= k \cdot \lambda \\ k &= \frac{100}{155} \\ r &= 15\, mm \\ d &= 250\, mm \\ \theta &\simeq 1\, rad \\ \lambda &\in [55, 155]\, mm \end{aligned}$$

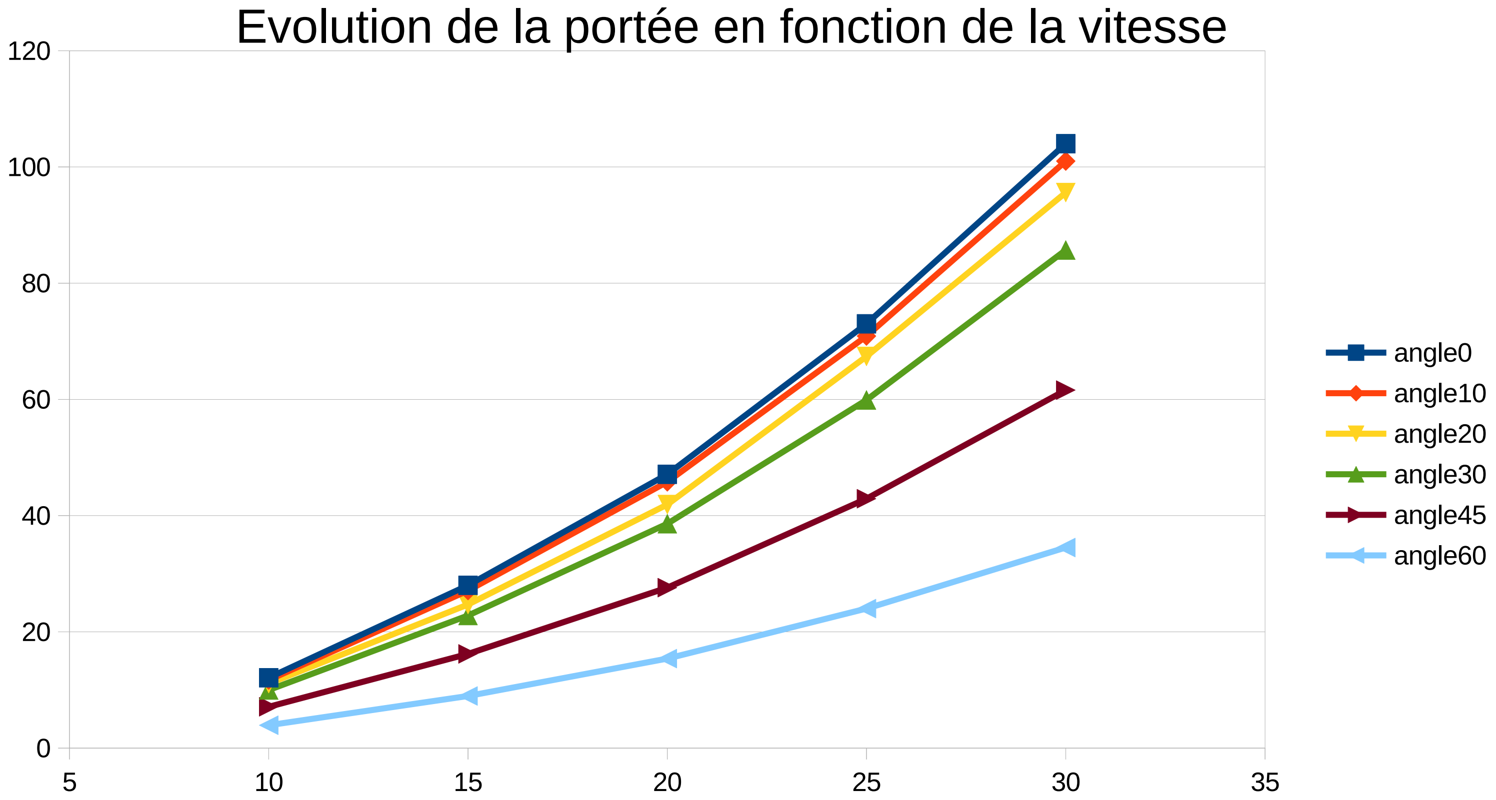
Code Arduino

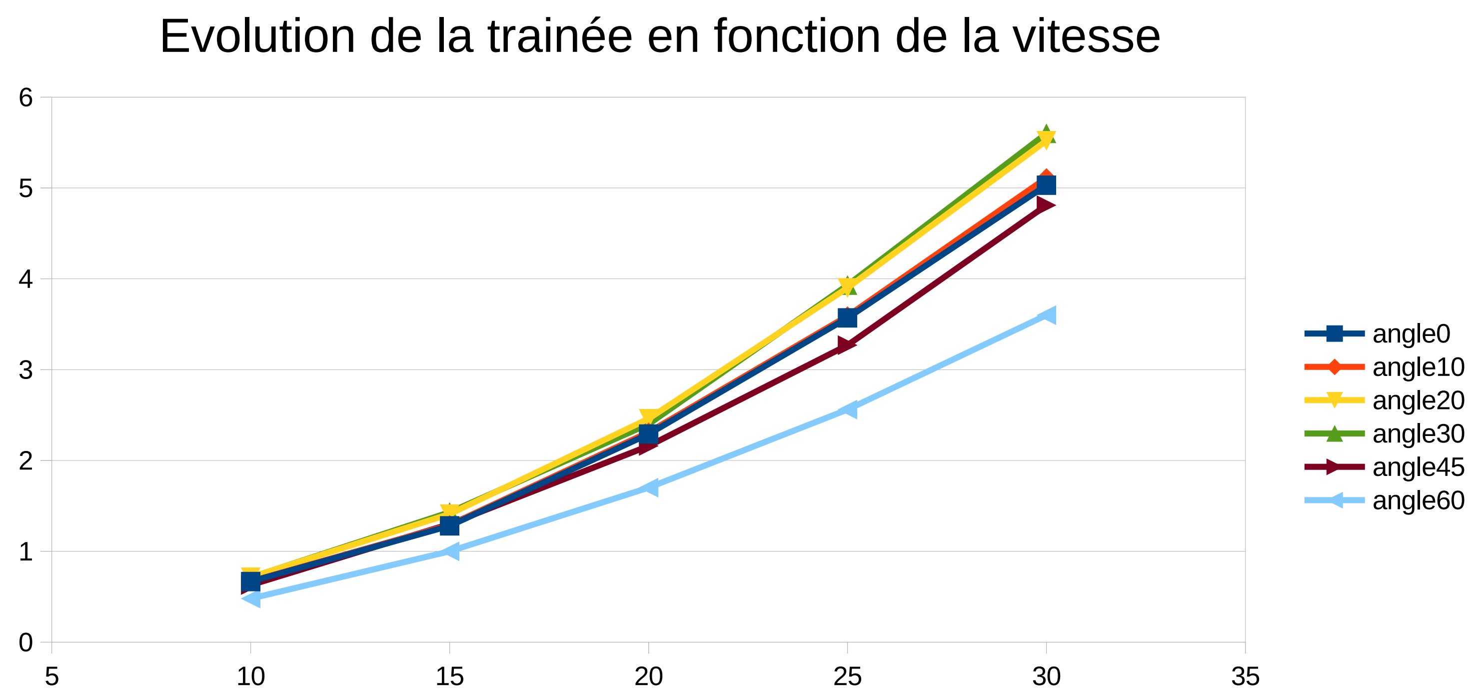




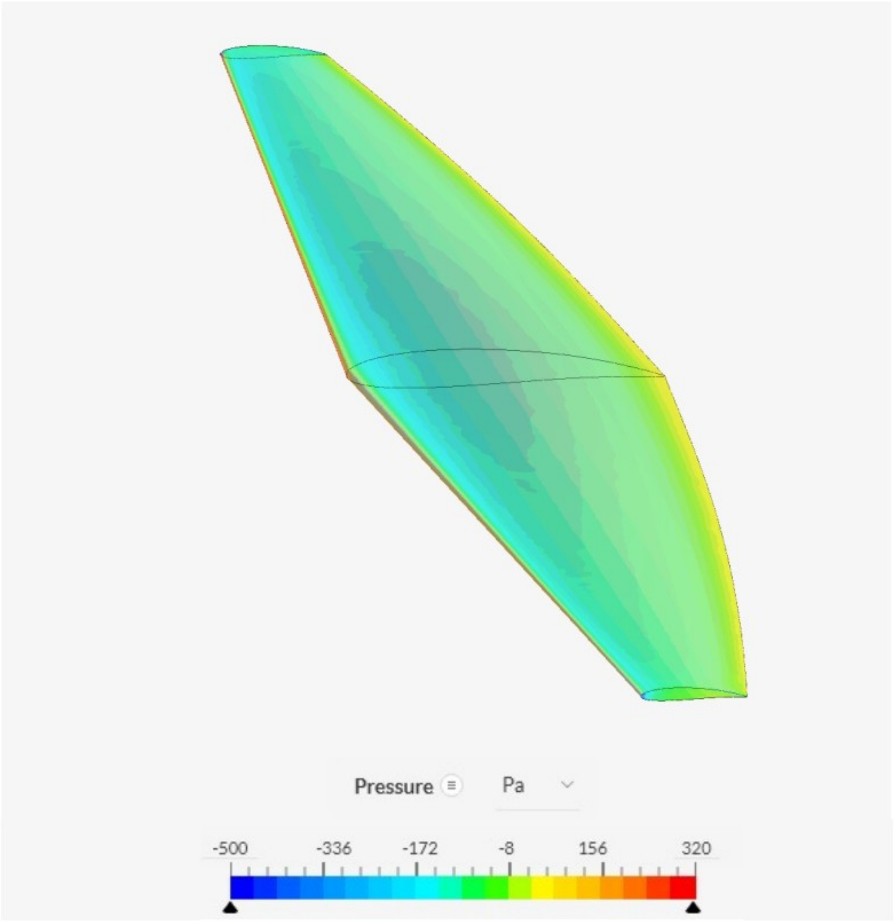

stm (Carte microcontrolleur) [VitesseGPS]
Lecture du nombre
Données valides?
Non
Oui
Lecture vitesse
v1 : donné par le GPS
Allumer DEL
Do/ iFileState 1
Calcul de vitesse
v2


stm (Carte microcontrolleur) [Ecriturel]
Données
a : angle de l'aile
v1 : vitesse donnée par le GPS
v2 : vitesse calculé
i : puissance du moteur
Ouverture du fichier
Données valides?
Non
Oui
Ecriture des données
Sur le fichier log{i}.txt
Allumer DEL
fileState 1

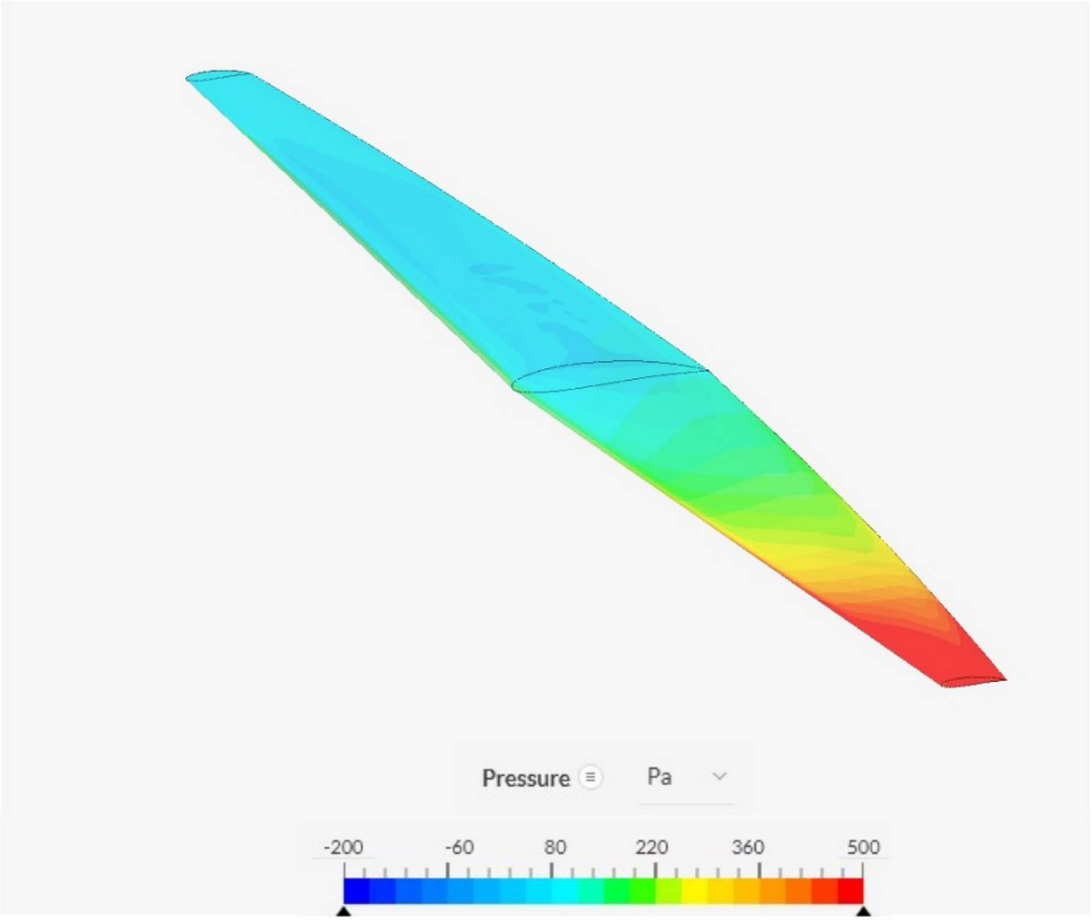

Evolution de la portée en fonction de la vitesse
120
100
80
60
40
20
0
5
10
15
20
25
30
35
angle0
angle10
angle20
angle30
angle45
angle60

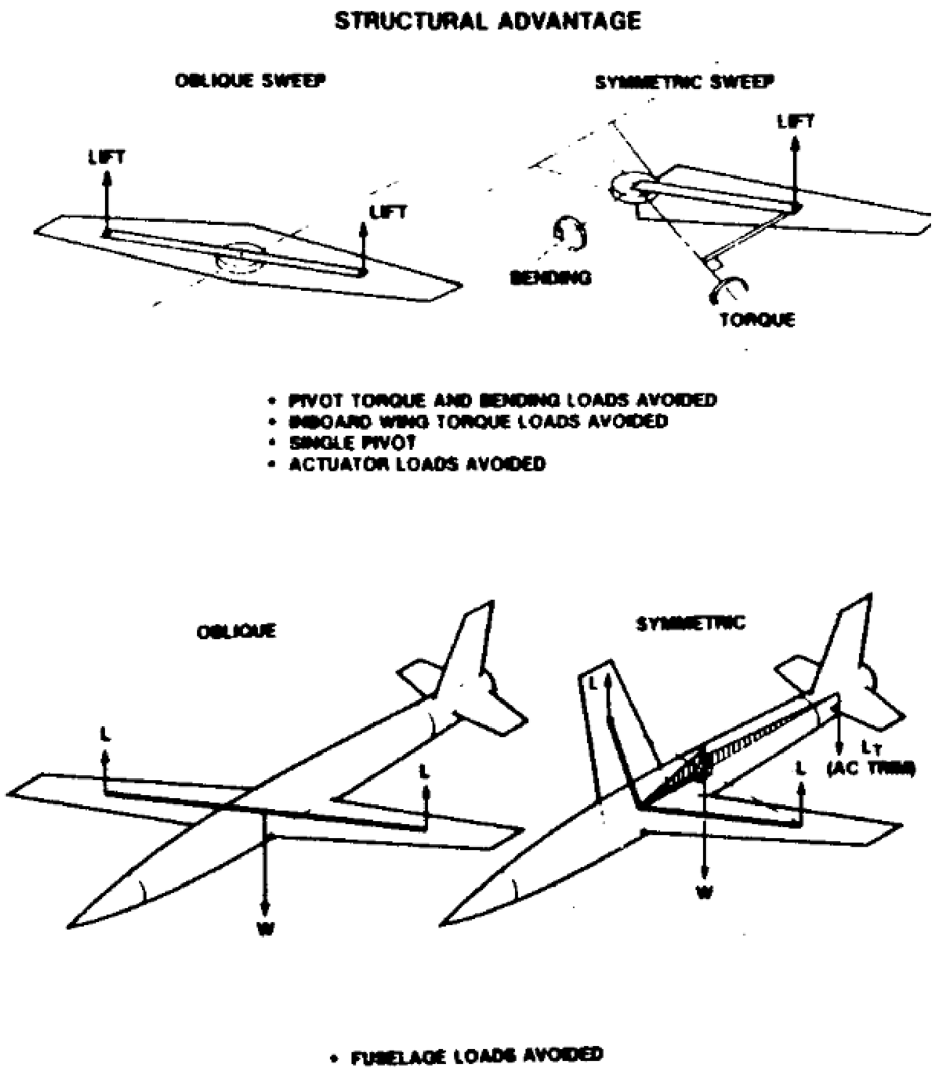

Evolution de la trainée en fonction de la vitesse
6
5
4
3
2
1
0
5
10
15
20
25
30
35
angle0
angle10
angle20
angle30
angle45
angle60

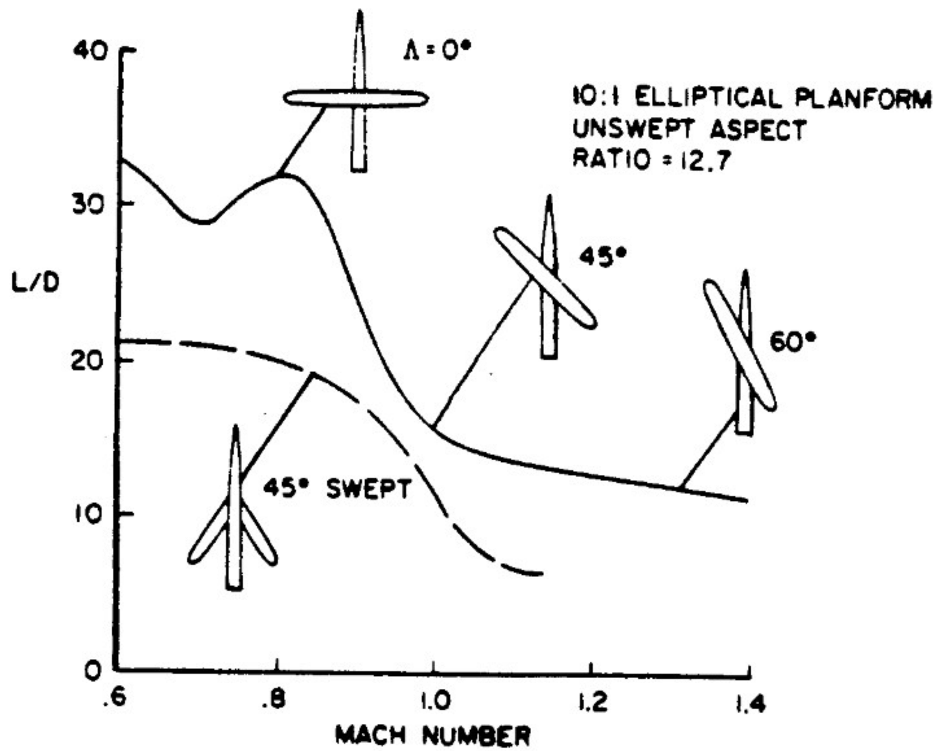
Angle de 0° à $30 m.s^{-1}$



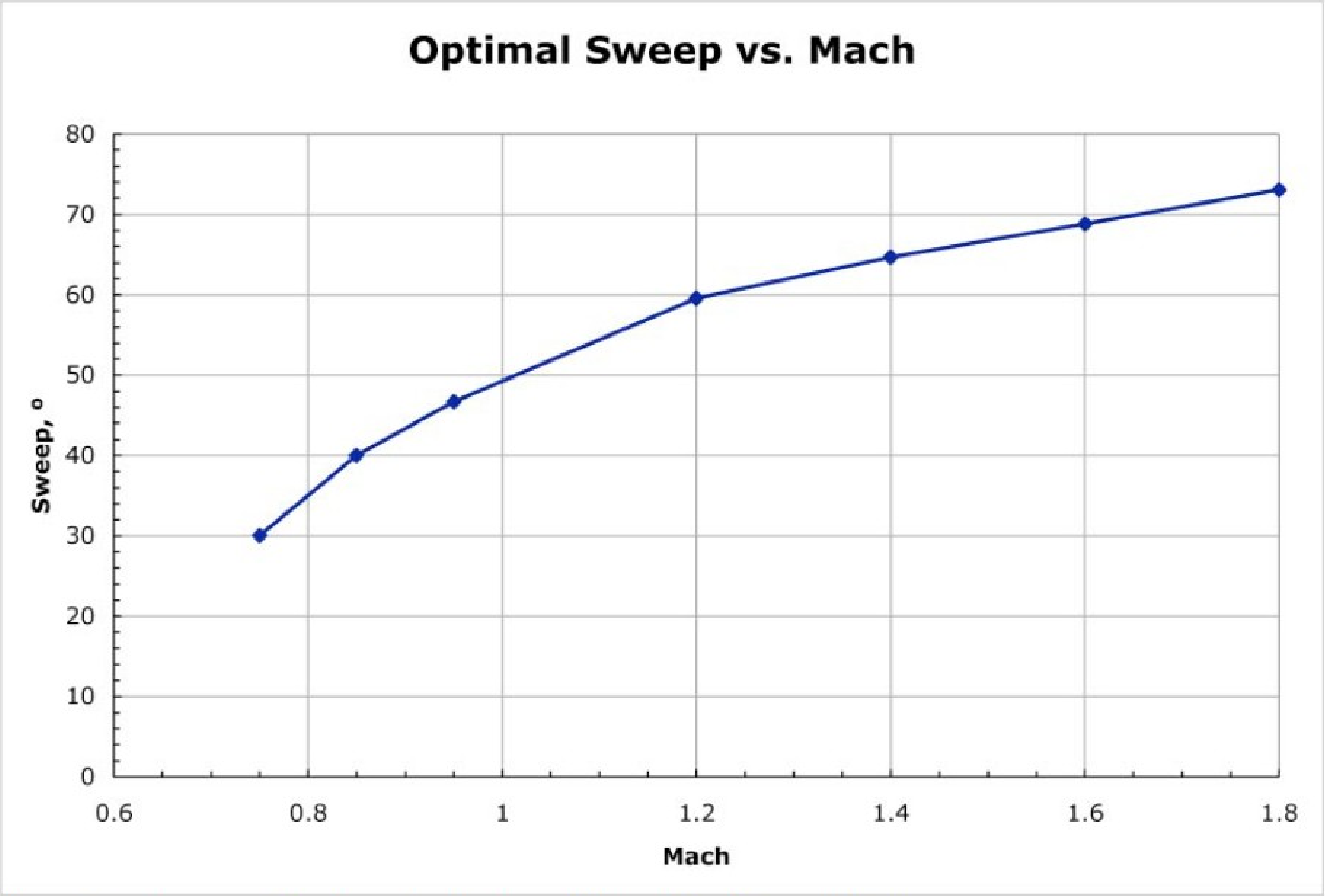
Angle de 60° à $30 m.s^{-1}$







Integrated Aerodynamic and Control System Design of Oblique Wing Aircraft, NASA



Sweep vs. Mach number for best L/D for AR=10, t/c=0.12 wing

Oblique Flying Wings, Desktop Aeronautics, Inc.