

PUSAN NATIONAL UNIVERSITY

DEPARTMENT OF NAVAL ARCHITECTURE AND OCEAN ENGINEERING

프로펠러 기하학

PROPULSOR SYSTEM LAB.

김 문 찬

Wednesday, March 07, 2012

날개 단면 용어

2

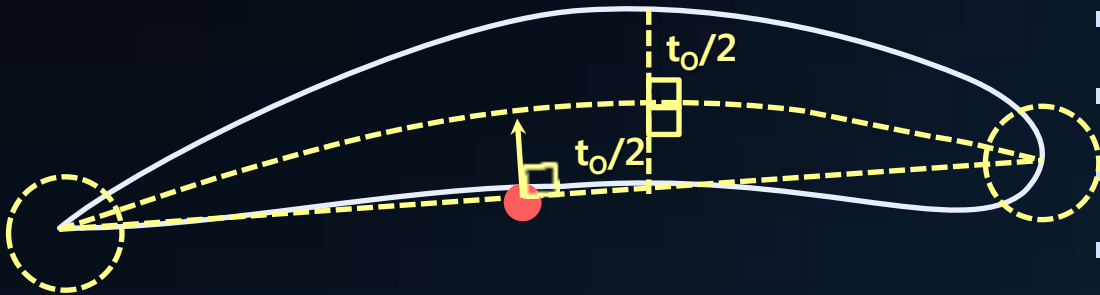


Fig 1. General definition of a propeller blade section

- Propeller blade section
- Leading edge
- Trailing edge
- Chord line
- Mean line
- Thickness
- Camber
- Blade section reference point

※ 대표단면 : Troost (Netherlands), MAU/PAI (Japan), NACA (USA), KH (Korea)

대표 날개 단면 비교 (MAU vs NACA)

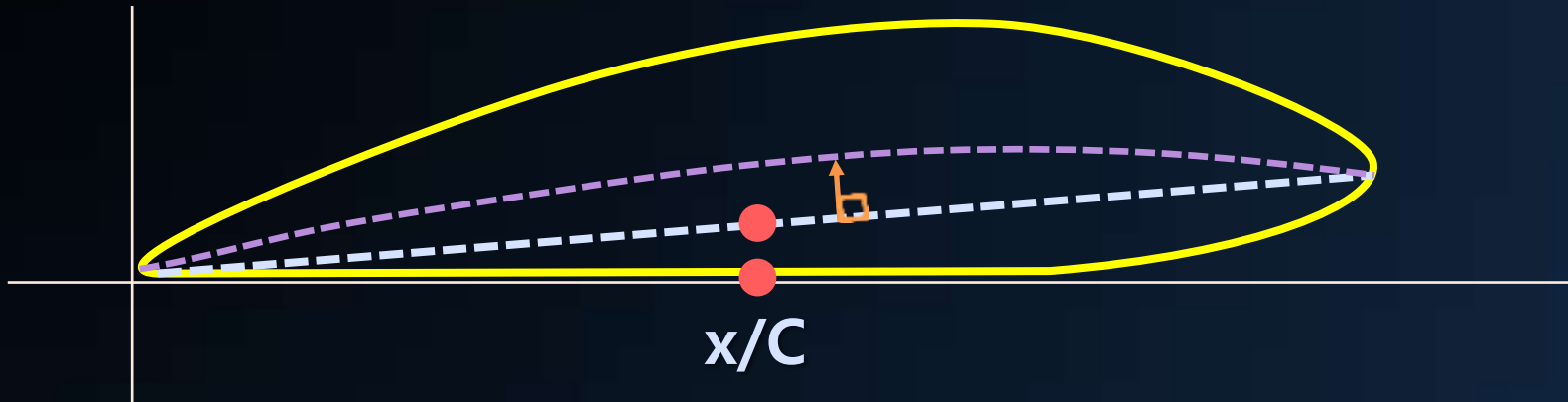


Fig 2. Definition of MAU section

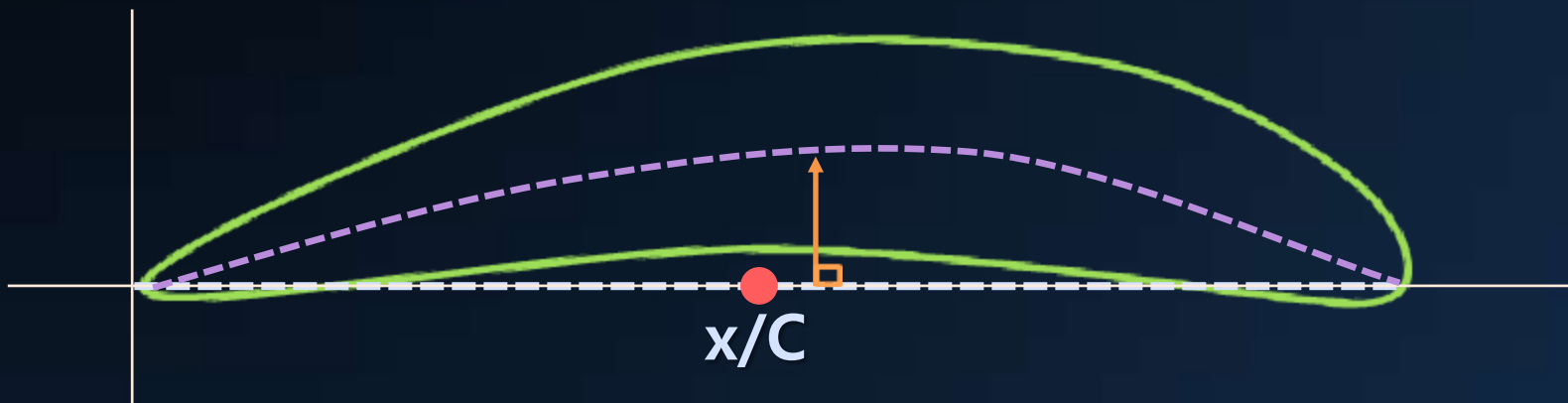
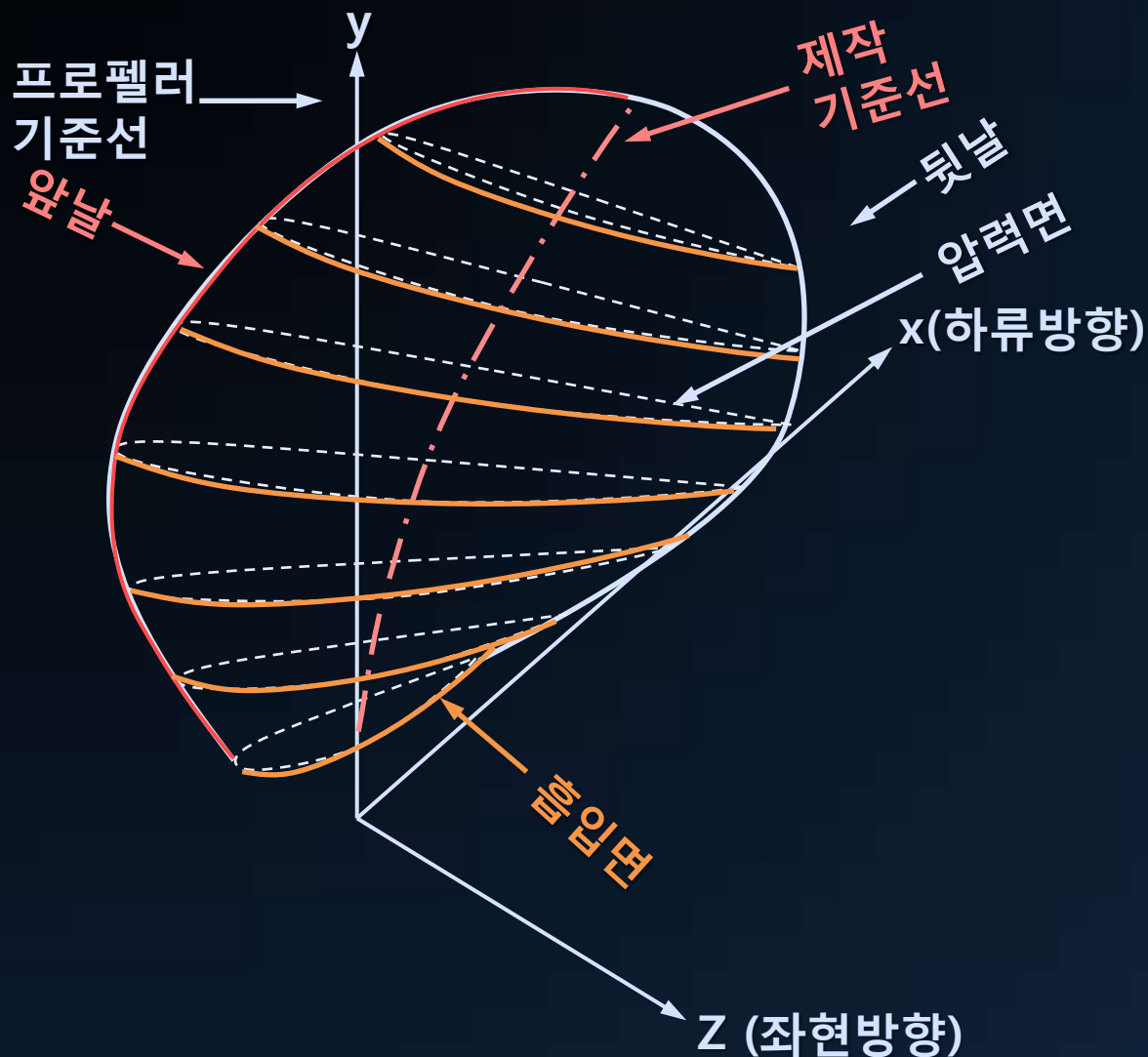


Fig 3. Definition of NACA section

----- Mean Line	----- Chord Line	----- Camber	● Blade Section reference point
-----------------	------------------	--------------	---------------------------------



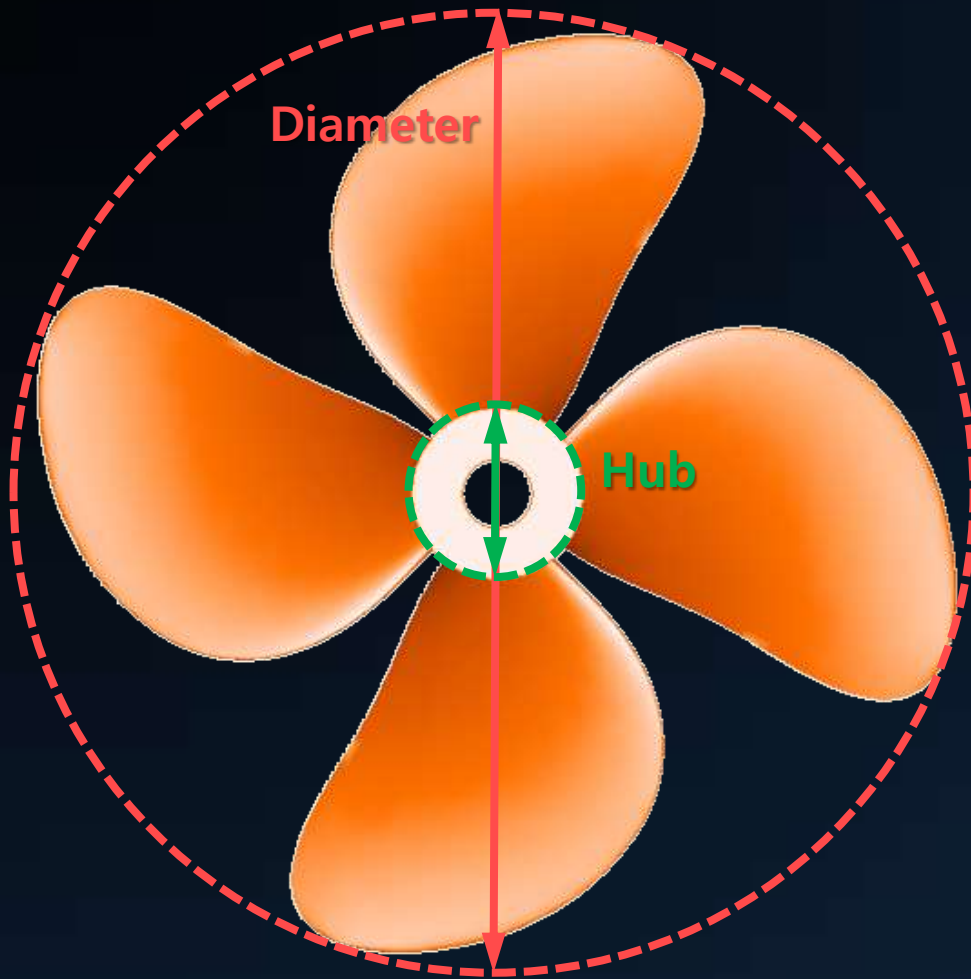
프로펠러 기본 용어



- Blade outline
- Propeller reference line
- Generator line
- Leading edge
- Trailing edge
- Suction side
- Pressure side

Fig 4. Definition of basic propeller geometry (I)

프로펠러 기본 용어

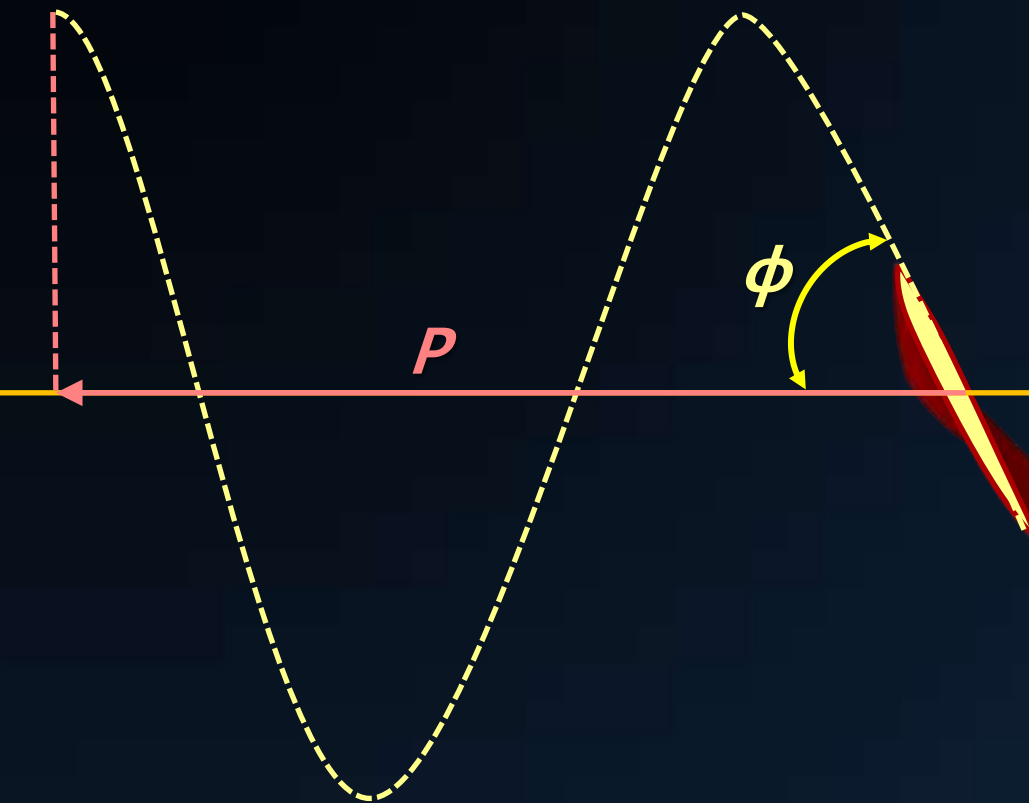


- Diameter, D
- Hub, d_H
- Pitch, P
- Pitch angle, ϕ
- Rake, x_G
- Skew, θ_m
- Blade thickness, t_o

- Pitch ratio, P/D
- Hub ratio, d_H/D
- Blade thickness ratio, t_o/D

Fig 5. Definition of basic propeller geometry (II)

프로펠러 기본 용어



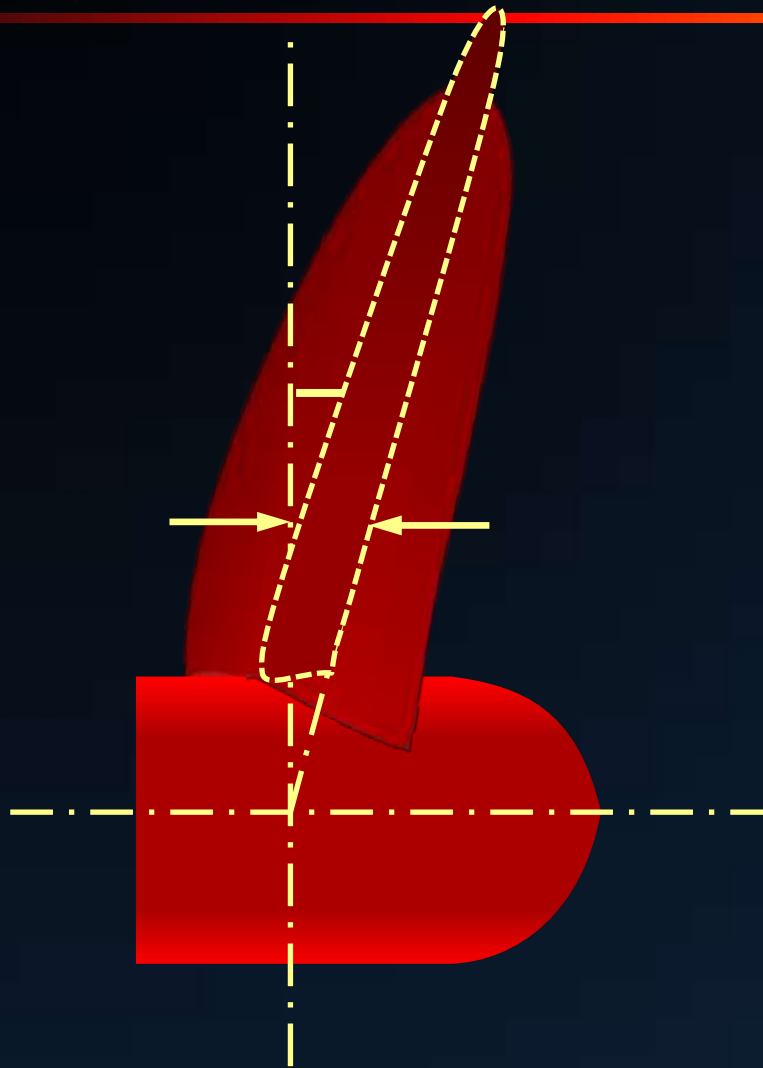
$$P = 2\pi r \tan \phi, \quad \phi = \tan^{-1} \frac{P}{2\pi r}$$

- Diameter, D
- Hub, d_H
- Pitch, P
- Pitch angle, ϕ
- Rake, x_G
- Skew, θ_m
- Blade thickness, t_o

- Pitch ratio, P/D
- Hub ratio, d_H/D
- Blade thickness ratio, t_o/D

Fig 6. Definition of basic propeller geometry (Ⅲ)

프로펠러 기본 용어

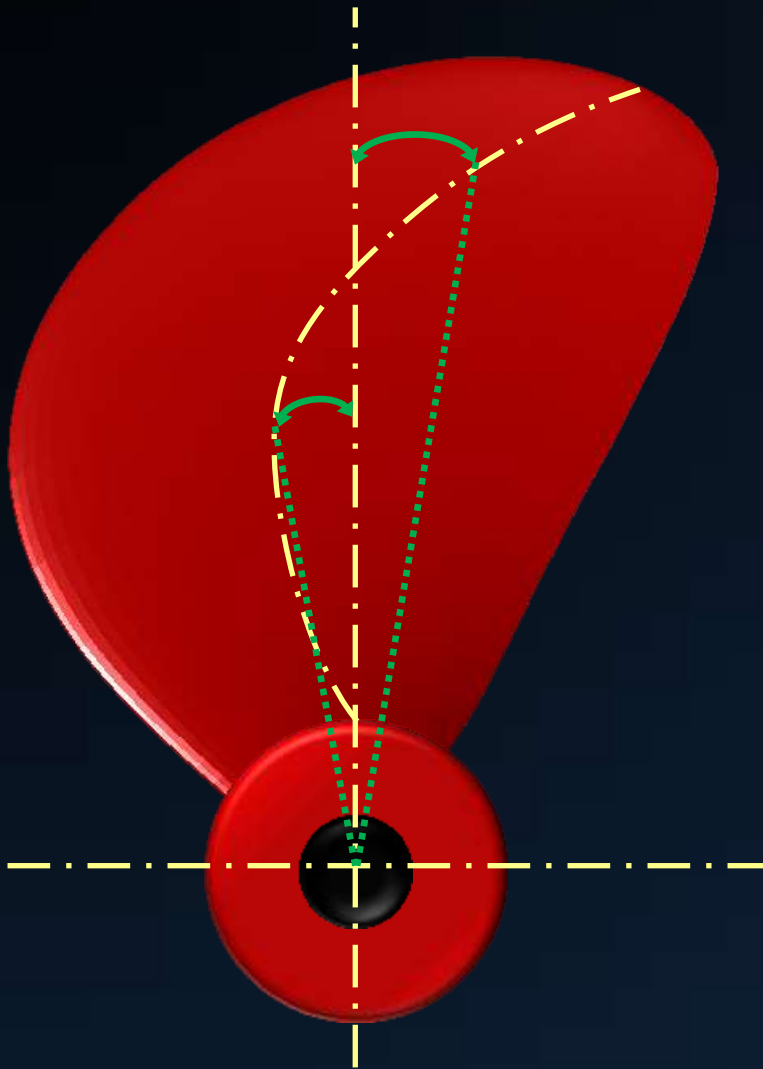


- Diameter, D
- Hub, d_H
- Pitch, P
- Pitch angle, ϕ
- Rake, x_G
- Blade thickness, t_o
- Skew, θ_m

- Pitch ratio, P/D
- Hub ratio, d_H/D
- Blade thickness ratio, t_o/D

Fig 7. Definition of basic propeller geometry (IV)

프로펠러 기본 용어

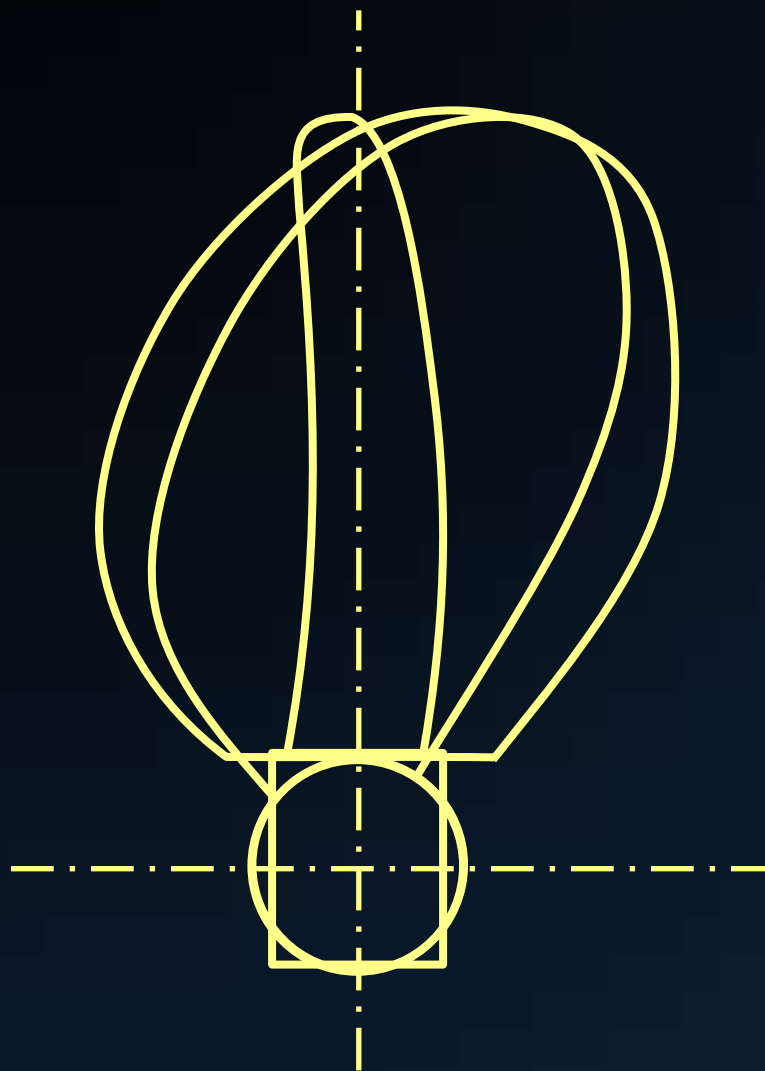


- Diameter, D
- Hub, d_H
- Pitch, P
- Pitch angle, ϕ
- Rake, x_G
- Blade thickness, t_o
- Skew, θ_m

- Pitch ratio, P/D
- Hub ratio, d_H/D
- Blade thickness ratio, t_o/D

Fig 8. Definition of basic propeller geometry (V)

프로펠러 기본 용어



- Swept outline
- Projected outline
- Expanded outline

Fig 9. Definition of basic propeller geometry (VI)



수식을 이용한 날개 형상 표현

- 각 반경에 대한 날개 윤곽선 좌표

$$x_{l,t} = x_G + r\theta_m \tan\phi \mp \frac{c}{2} \sin\phi$$

$$\theta_{l,t} = \theta_m \mp \frac{c}{2r} \cos\phi$$

$$y_{l,t} = r \cos\theta_{l,t}$$

$$z_{l,t} = r \sin\theta_{l,t}$$

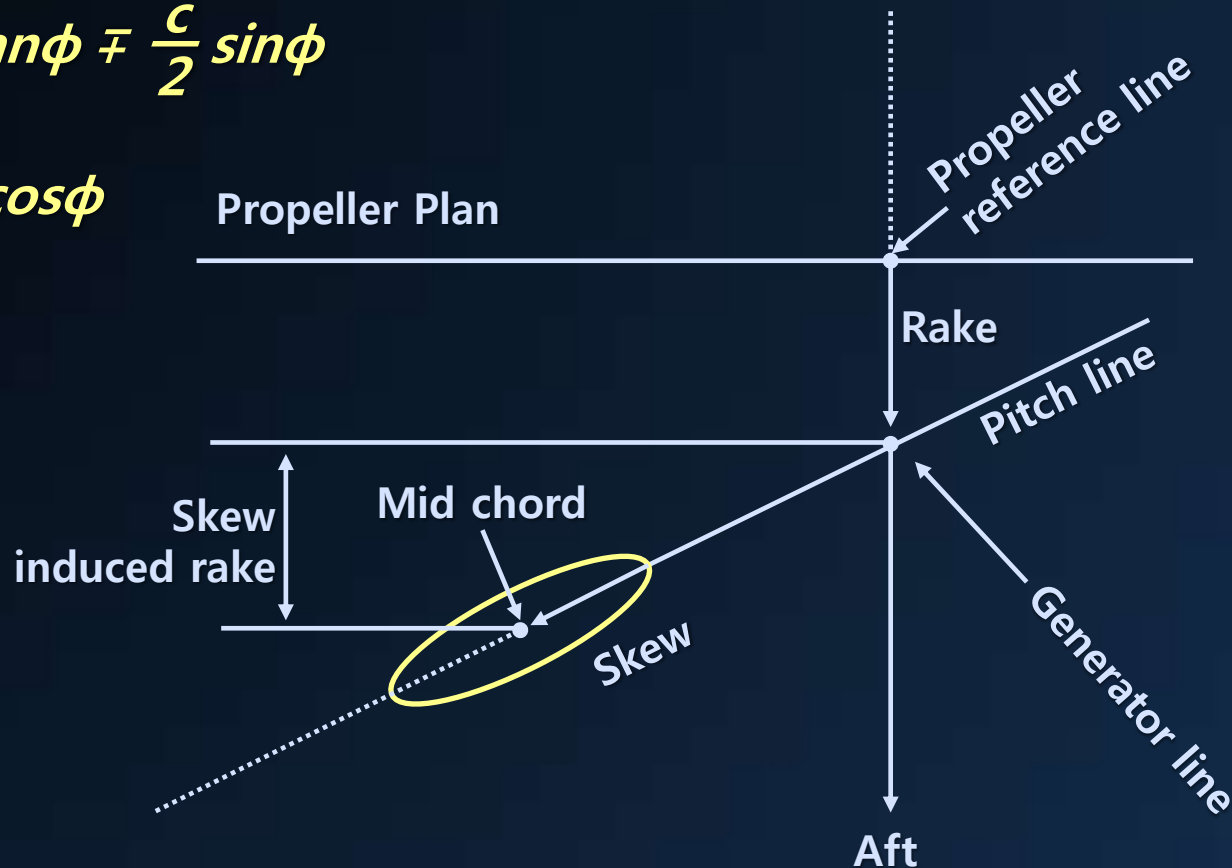


Fig 10. Propeller geometry in x-rθ coordinate (I)



수식을 이용한 날개 형상 표현

- 날개수가 Z인 프로펠러의 3차원 형상 좌표

$$\delta_k = \frac{2\pi(k-1)}{Z}, \quad k=1, \dots, Z$$

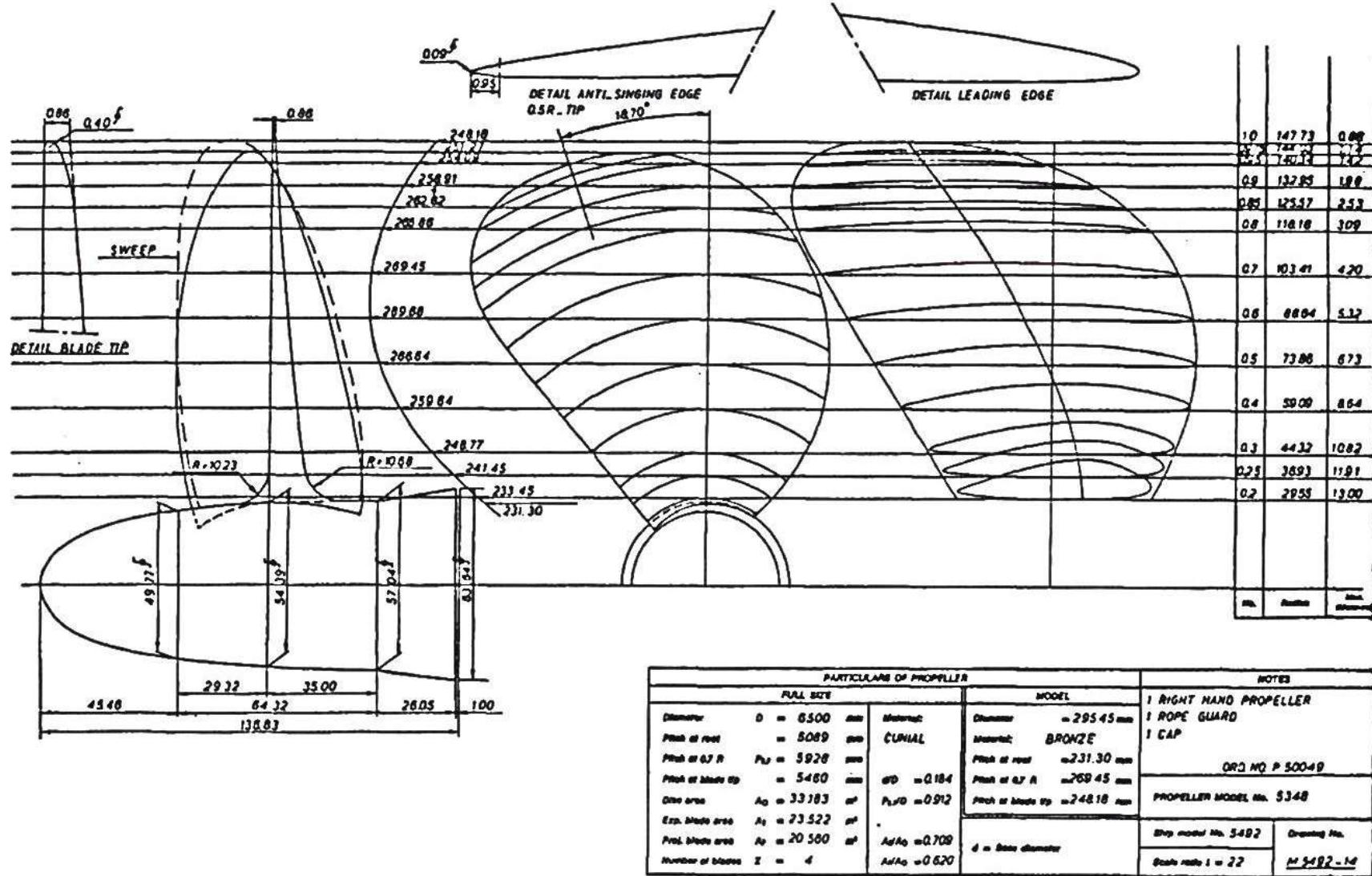
$$x^\pm = x_G + r\theta_m \tan\phi + c(s - \frac{1}{2})\sin\phi - f\cos\phi \mp \frac{t}{2} \cos\psi$$

$$\theta^\pm = \theta_m + c(s - \frac{1}{2}) \frac{\cos\phi}{r} + \frac{f\sin\phi}{r} \pm \frac{\frac{1}{2}\sin\psi}{r} + \delta_k$$

$$y^\pm = r\cos\theta^\pm$$

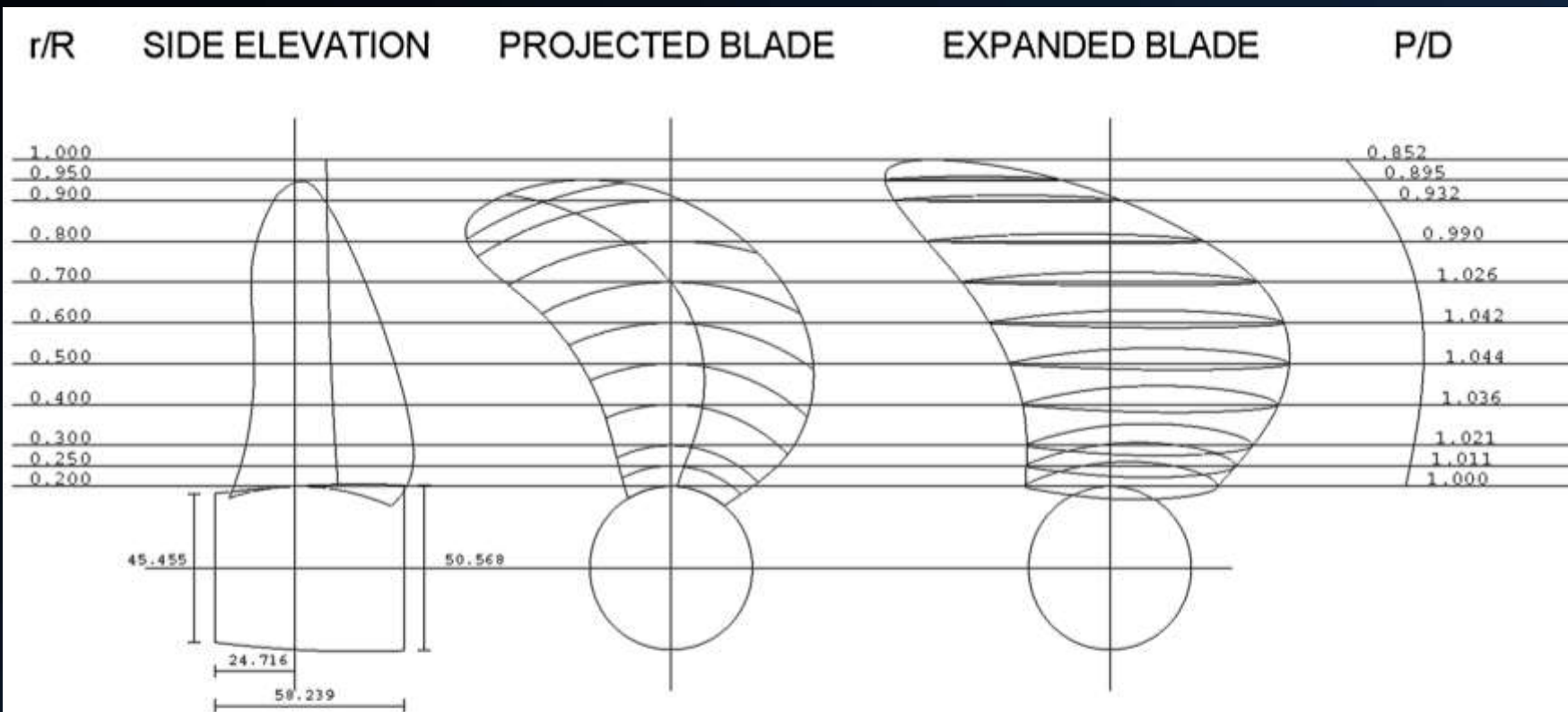
$$z^\pm = r\sin\theta^\pm$$

프로펠러 도면 예 (MAU)





프로펠러 도면 예 (NACA 66)



Propeller Principal Particulars					
Diameter(mm)	8800.0	Model Diam(mm)	250.000	Scale Ratio	35 2000
(P/D)mean	0.9900	(Rake/D) Tip	-0.0352	Prop. Type	FPP
Ae/Ao	0.9445	Eff. skew(Deg)	35.00	Drawing Scale	1.80556
Hub Ratio	0.2000	(C/D) 0.7R	0.3633	Comment	
No. of Blade	6	(F0/C) 0.7R	0.0106	Prop. Number	
Section	NACA66	(T/D) 0.7R	0.0165	C N U	