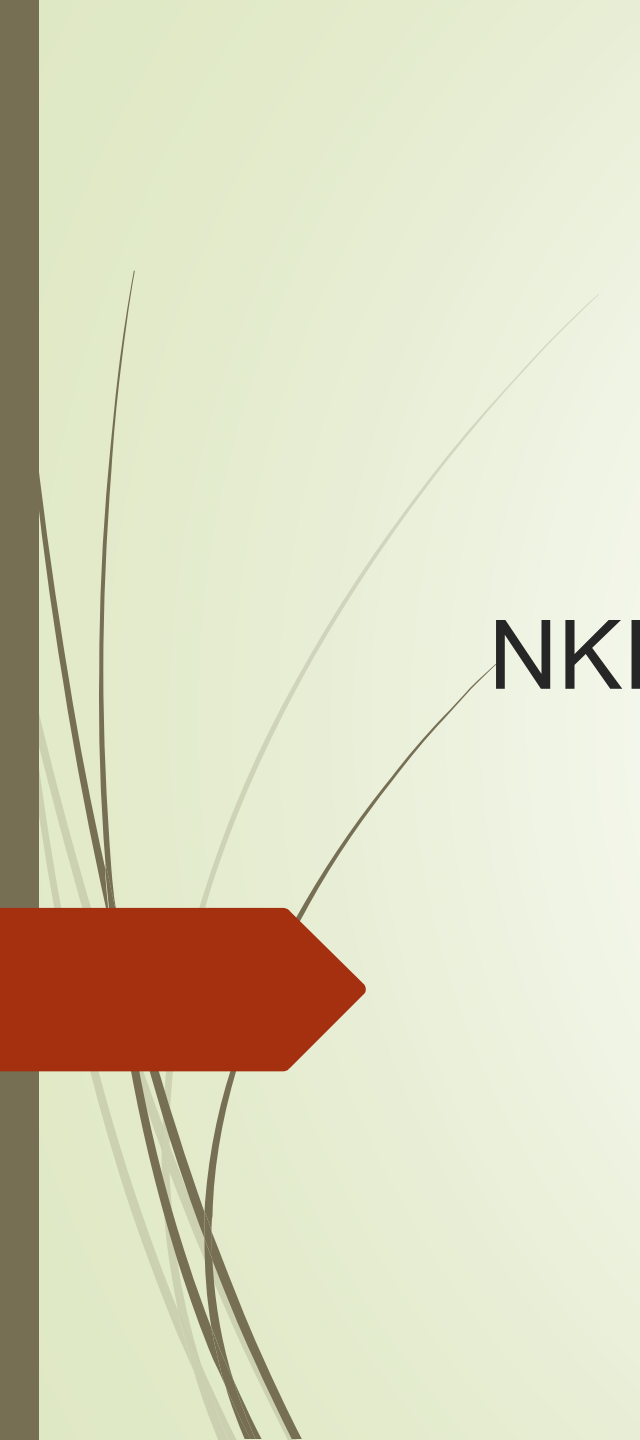


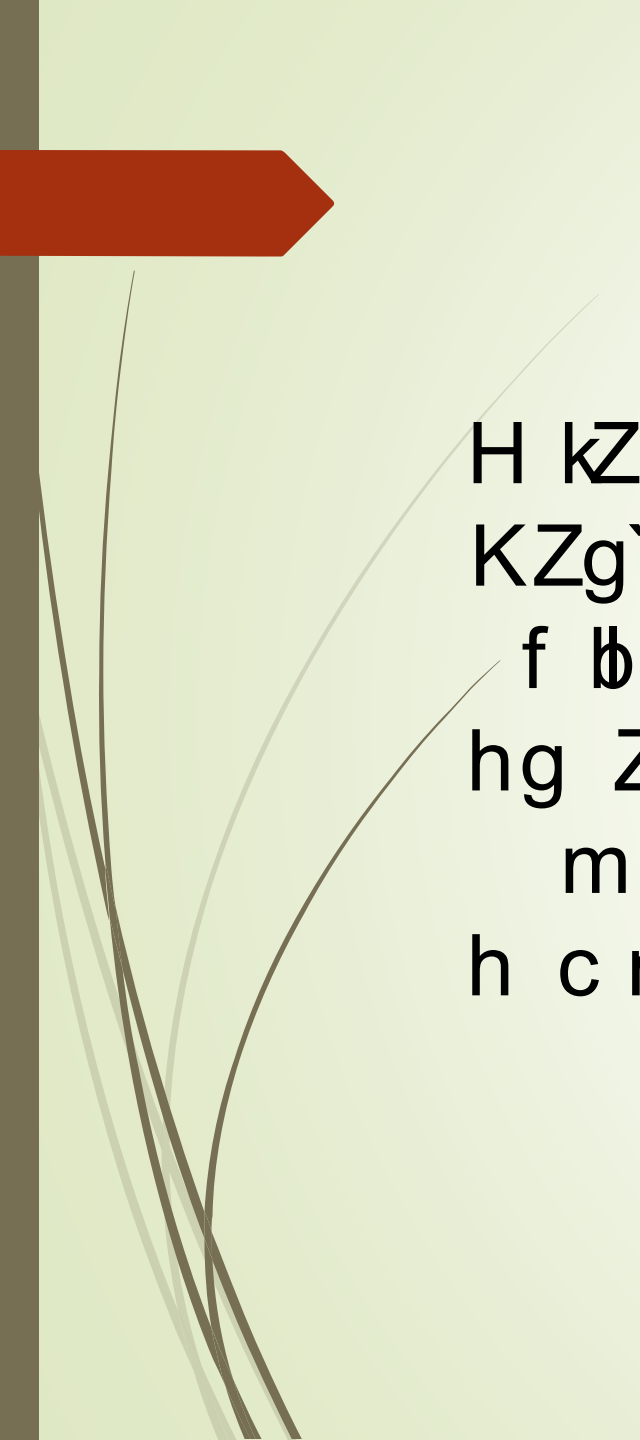


NKLH >LI > B E > HI >K: HK: KI:

K: : K



M h k Z h K Z Z k



H kZ Zk Z k gb h i ZkZ KZ bn m rhg Zg
KZg` bg` ZI bZl ng Zf gnZe gm gZ
f bl h hg ZI ehf Z` gZrbZ f bkh
hg ZI gZZg e I nl k eqhl i ZkZ
m mZk%en ZesZk f kZo en bZ
h c ml



H ng bngZf gh i kg b ZeZl f eZl Zh
i kg Zlh h h l hghkh3h kZ Zk f bn nf
ineh%jn Zng` nf h cm k rhkgZ ZgmngZ



Hi i kg Zf gn Zb j n k ` f hl l b mf Z
kZ Zk3

H kZ ZkZgl f bn g k bZ k bn
ZkZ k j nZg bZ f bkh hg Z i ZkZ h li Z h J nZg h
l l Z hg Z g hgrkZf nf h c rh Zeh %nf Zi Zkm Z
g k bZ Zk erbZ oheZ Zh kZ Zk
H l gZek erb h j n k rhkgZ Zh kZ ZkZ aZf Z h
h
k bn gZeb Z 3 Zgm gZ h kZ Zk hg grkZ Z hg Z
f nf bq k bn gZe: h kZ rk ZkZ k h hg h
h k rhkgZ%h kZ Zk mkf bgZ Zi hl b h Zg` neZk
Zsf nm h Zeh



: bmg bZ Zn nf h c rh Z Zene Z
f b h h m f i h h k b h m g r k Z f b l h k i h h h
hf h Z hg Z e r k h f Z g Z r b Z o b Z c Z f
o b Z Z e s ,)))) df (l % bmg bZ
df (l % bmg bZ K Z Zene Zi e Hf ne Z3

$$R = \frac{c \times t}{2}$$

b b l i h k + i h k j n h m f i h k ` b r k h Z b Z o h e Z % n
l c Z % h k Z Z bmg bZ k Ze

Nr~~es~~Z h i ZkZ f kZo e bZ h c rh
j n l Zi khqbf Zf hn l ZZnf o e bZ kZ bZe
L h h c rh l m f f h obf grh%Z
k j nZg bZ h l bZek e r b h h f n Z f k eZ h k j nZg bZ
hkò bZgZe f b b Z: b k g Z grk Z k j nZg bZ f b b Z Z
k bZZ k nZf gm i k h i h k bZgZe o e bZ h Zeh







HI kō hl Z kZ bZ h e k f Z` g Z b Z hl
i kh b f g h l l ` n k Z g Z
g l l kō l

: hi kZ h hf kZ Zk l gohe Z f bl h hg Z
en hf Z` gZb Z ZeZ k j nZg bZ ` kZe gm f b kh
hg Z % n l h eZ l bb Z Z hf h kZ bZ h g h b g s Z gm
> f hkZ g h Zgb j n f h G: k nZ f gm hf h hl kZ bl
Q%Z qi hl b h b g m gl Z Z kZ Zk l i h i k h o h Zk bhl
b e H b hl l b gbb Z n o hl ob h Zh Zj n bf grh hl m b hl %
qb b g h k b h k hl hl i kh bf grhl l ` nkZg Z



HI kō hl ʔI h bʔ hl ʔ f b ʔ
I ʼ nkʔg ʔ II g bʔ 3



Kb hl Z BkZ bZ h >enhf Z` gZrb Z KZ Zk

H i k g b Z e k h

Z h Z n f g r h Z m f i k Z m k Z h h k i h a n f Z g h %

l b b Z k Z n f h k g h f b k h h g Z : k h l h f Z b q h

e n q h l Z g ` n Z h h % h f h h e a h l m l n Z h e l % h

i Z k b n e Z k f g m l n l m d b % h g h l g o h e k

Z n k Z n h n i k h e f Z k n e Z

> q i h l b l

Z e Z b g m g l b Z i h f Z n l Z k j n b Z n k Z g Z i e

Z g h l f m b h l b g m k g h l

> l m h l b b Z f

j n Z q i h l b h h n i Z b g Z e i k h e g` Z Z i h l n k
Z l h b Z Z Z h k l Z Z % Z g l b Z % b g l g b Z %
Z b Z % f Z h l q k f h l % Z e n k Z l g h l b m f Z
g k o h l h g r k Z e

: k Z b Z h Z e Z

b g m g l b Z i h b g n s k h k k g m l e z k b Z f
f Z m k b Z b f m e h l % h g h Z n l Z k b g b h
f Z m k b Z b g e Z f o b h n q i e l b o h l e m k b Z f g m
b g b b Z h l



l kh

bf

grhl

L

`

nkZg

Z

gZHi

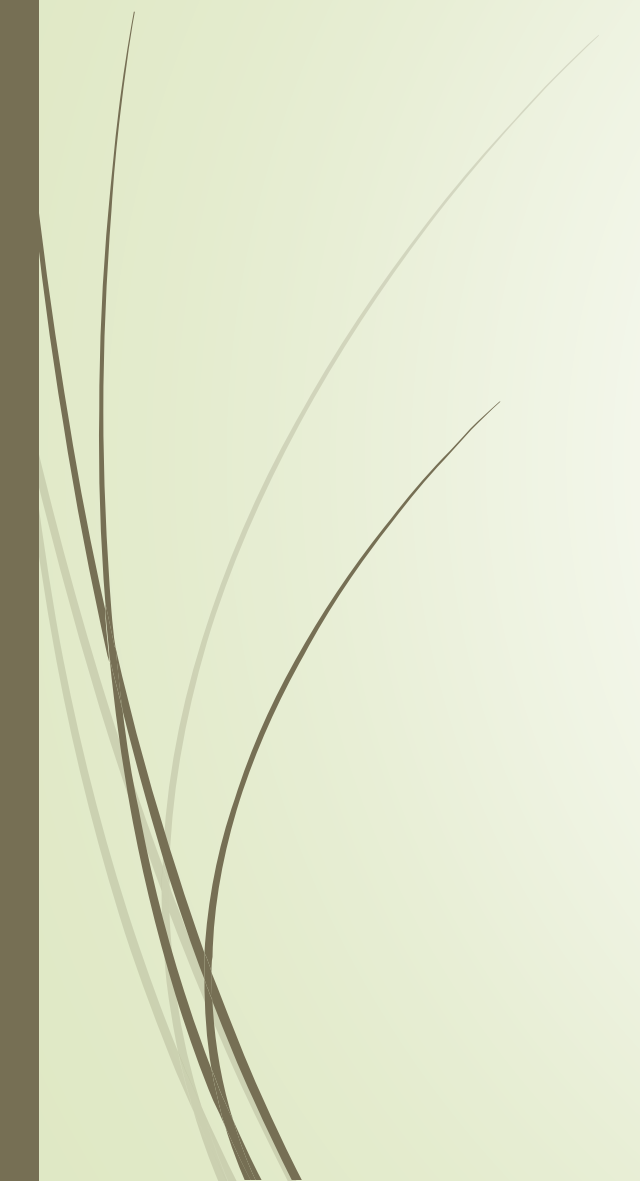
kZ

h

hf

KZ

Zk



: i km h Z bZl f mZ i bZk l 3
mf i h% bmg bZ eg Z` f

bm̃g b̃z L `nkZg Z ShgZ >q eł h 3

k Z khgñe3 Z f Zb̃ i kò hl Z: j nb̃ ñz gb Z
o ob̃zk̃h b̃q b̃k rh ZZgm̃gZ >f hi kZ I
ghkf Zb̃ %nf Z f Zk` f I `nkZg Z - f r̃hl
k gm Zk hf g Z Z%h g hl kf Zb̃k Zñz+) f
hn f Zb̃ f ml ml % i g g h Zi hñz b̃z h
kZ Zk

k Z Mk̃Z b̃kZ3 o I f Zgm̃knf Z b̃mg b̃z
I `nkZ Zr̃k I ZZgm̃gZ `kZef gm Z b̃f Z +
f r̃hl



+ Ebf bZ h M f i h3

G h i kf Zg kgZmZc mHbZ h b i hk
f Zb / f bgnrhl hgnZhl f k Z ZeZ
qi hl b h%hg hkf ghkf Z l `nkZg Z



, ; eg Z` f ; Zkk kZ 3

NnesZk eg Z` gl HbZ i Zk l hf
i khm h K grk h rkZgl f bl hk k Z
bk neZ h

FZgnmg h o l k bZ hf h
rkZgl f bl hk l eZ h L g ll kb%h
i llhZe o i kf Zg k l rkZf gm
Zrk l h k ehki ZkZ Hh



- L b g Z e s Z h l k h b f g r h l 3

k Z Z e z k Z b Z h o f l k e z k Z f g m
l b g Z e s Z Z h f l b g Z b Z o b h k Z b Z h g h
b n g l s Z g m
N m e s Z k f h g b h k l k Z b Z h K
h l z h n h l i Z k Z f b k h g z h e q i h l b h f
m f i h k Z e % Z k Z g r b g h j n l m c Z f Z Z b h h l
e f b n l l n z e b h l h f h h l Z B G B K I



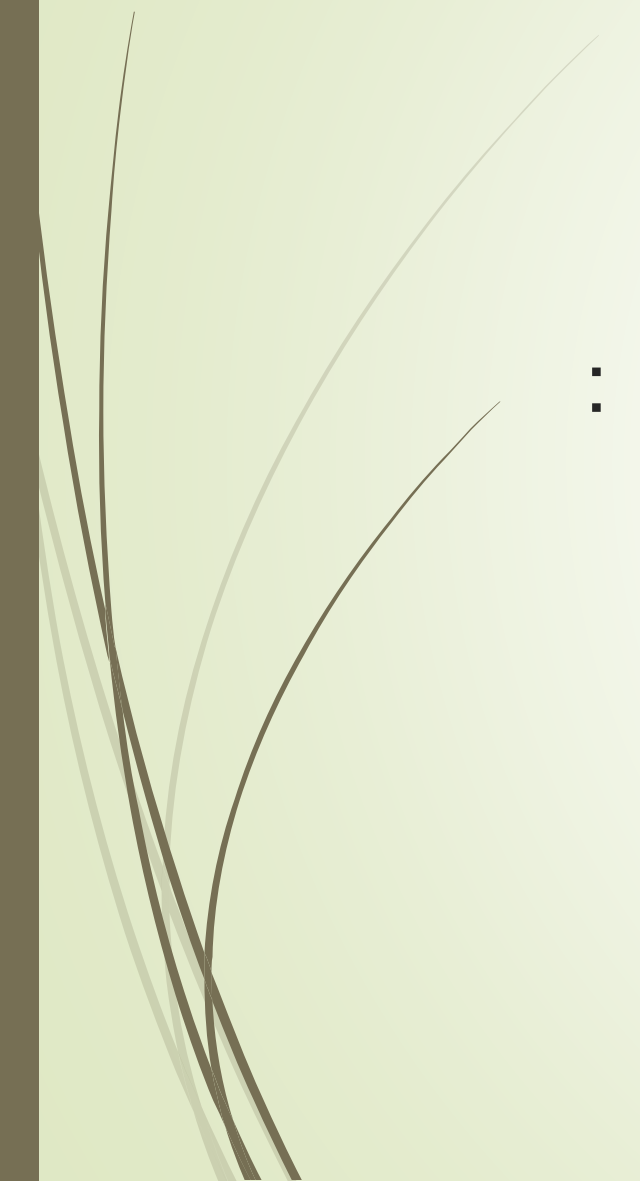
. Mk bZf grh3

Hi kZ hk l o f l krm bZ hl i ZkZ k hga k

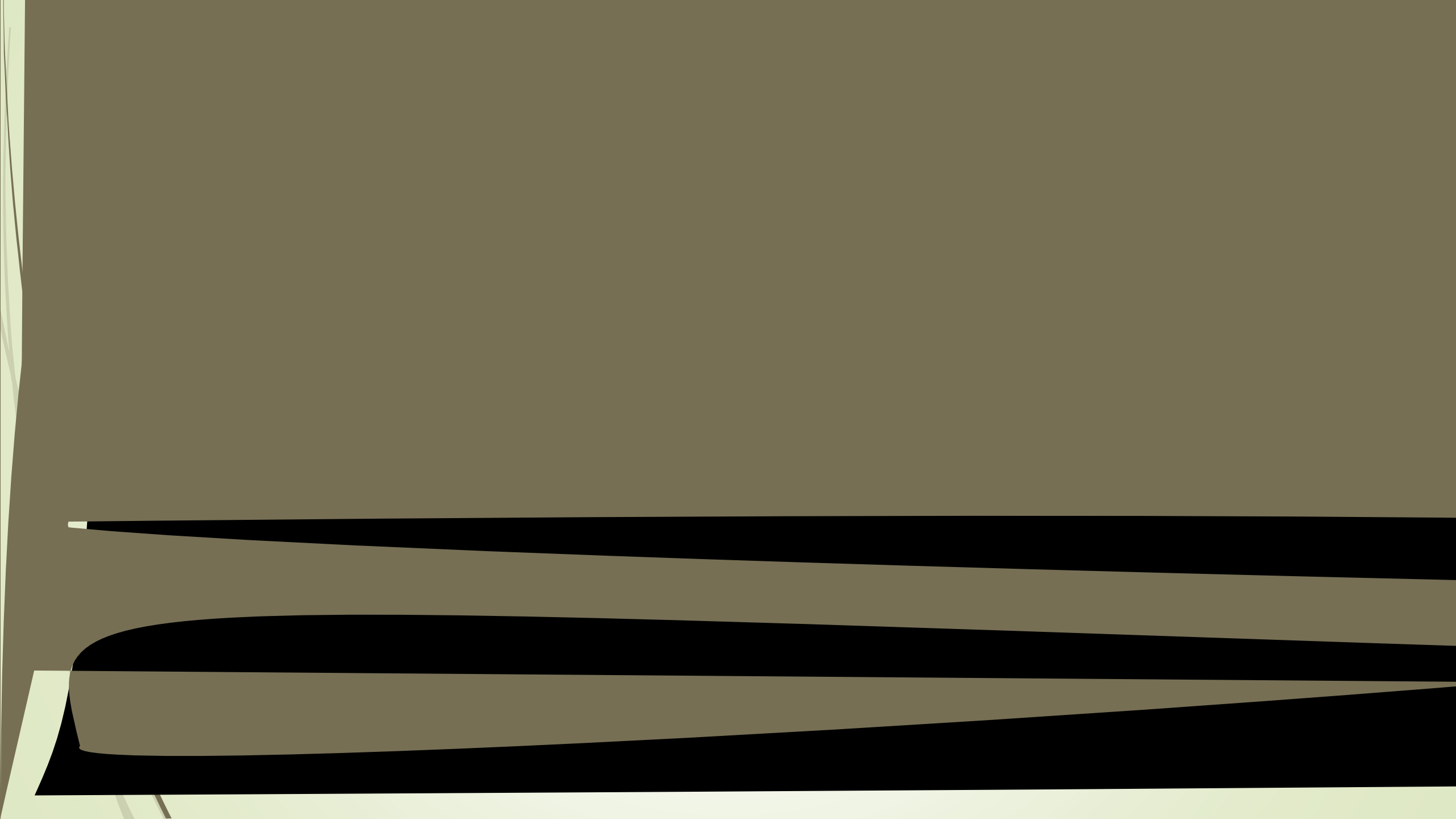
hl i kò hl % gmg kh bZ kZf Z bkZ bZ h Z

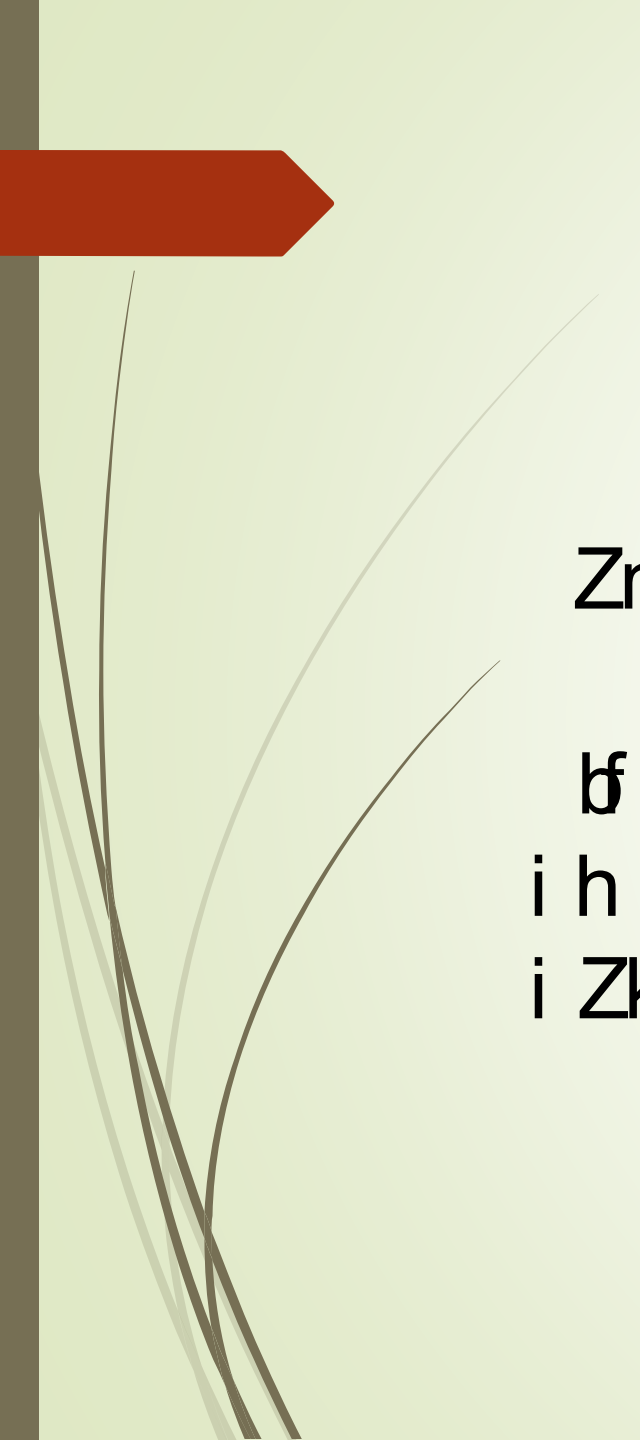
ZgmgZ l Z k hf h Z bk f l bnZ l

f k Zg bZ



: k eZ h grk h ZeZg f qbf h Z
k j Zg bZ k i nb h i neh





l kf bn m h o e b Z
bh hi i e k % Z k ns h ZeZg f qb h %
Znl Zg h Zf bn b Z f Zehl bn Zgml
: nf gm h ZeZg f qb h % Z
bf bgnbZ i k b h gZf b h o e b Z
i h ` kZkZf bn b Z l ZeZg Zehl
i Zk f f Zb i k qb hl h j n l mh

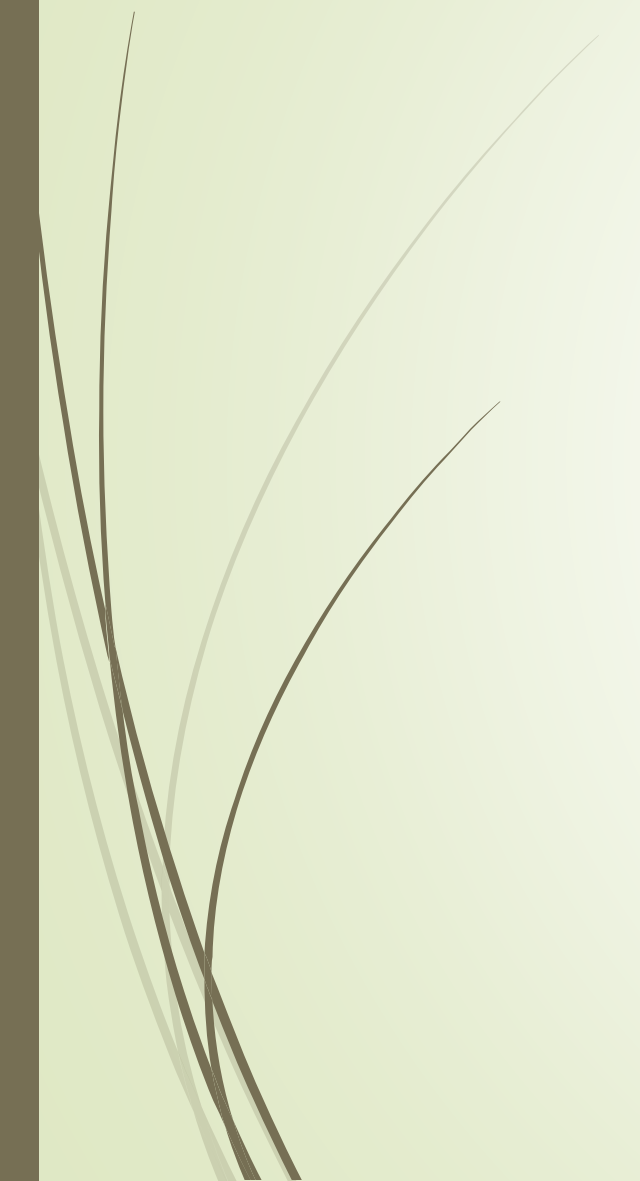


h l g o k h Z I K $(PRT = 1/PRF)$

H m f i h g r k i n e h l o i k f b k j n h h k r h k g Z g m l h
i k h q b h i n e h l k f b b h

3 > l h e a k n f Z I K Z n f h f i k h f b l h g r k Z
g l l b Z n f e n g ` h Z e Z g Z b q Z I K n f Z Z e z
o e b Z f b h Z e z I K

3 L h h k r h k g Z k Z i H i k h q b h i n e h l k
f b b h m l K M % h k Z Z k Z l n f k h g Z f g m Z b m g b Z h
i k h q b h i n e h

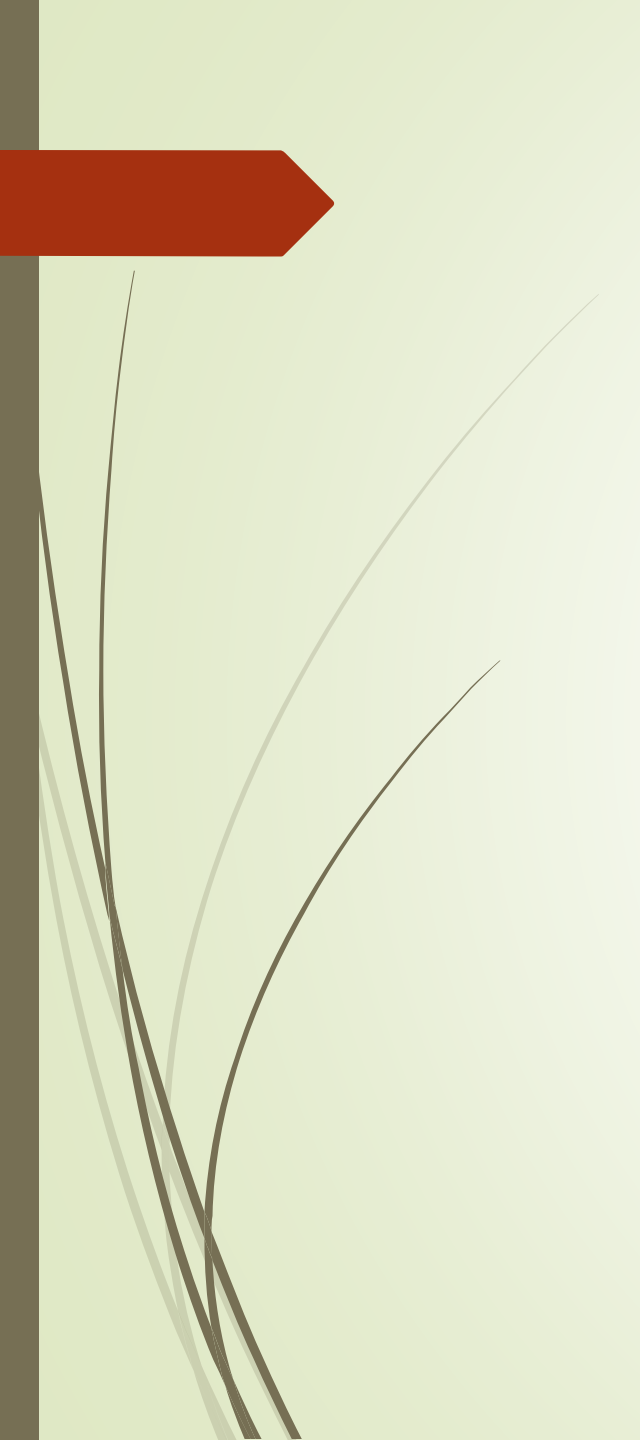


K ē h grk h Ze Zg Z g k` bZ
rkZgl f bb Z nf kZ Zk

: k e h g h ZeZg K Z g k bZ(i h nEg bZ
nZgl f bb Z l m nf kZ Zkg h ZeZg Zk% g h
`ho kgZ Zi e j nZ h h kZ Zk%hg h ZeZg
f qb h Z

$$(R \propto \sqrt[4]{P_t}).$$

BI h l b gbb Z j n % ZkZ h kZkh ZeZg
m h nf ZeZg%Zg l l kZn Znf gnZkZ
i h nEg bZ nZgl f bb Z f / o s l



Pontos chave da relação:





g k` bZ rhmZe
mZgl f bZ ZZh i kh nrh Zi hnmZg bZ i bh h
mZgl f bZ hki eZ nkZ h h ineh eZk nkZ
i neh l neh f Zb eng` hl mZgl f bnf f Zb
g k` bZ% kf bng h f ZbkZeZg %f Z
bf bng h Zk l hen h bmg bZ
3H ZeZg mZf Zf
i g jn hl gl eZ h k i mki ZkZ
m mZkl bZb kZ hl ZbZk eZ hl bZeknZ h

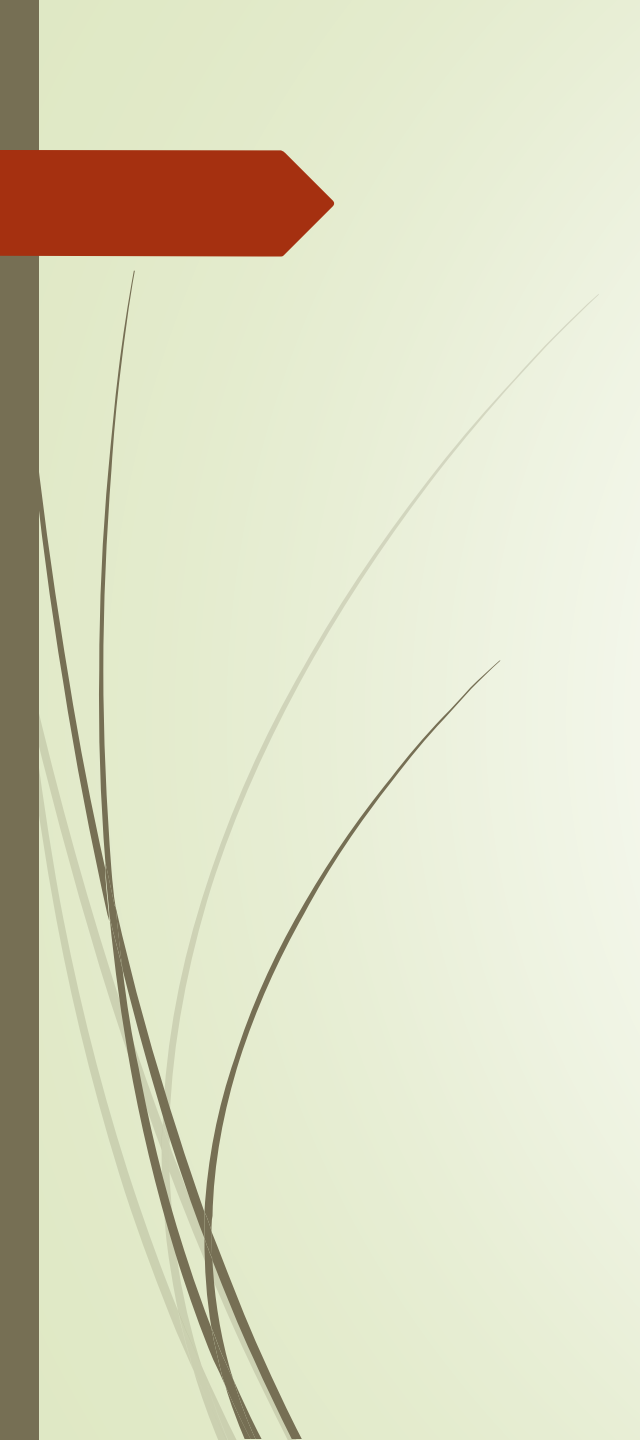


> j nZ h l b i e b Z Z h Ze Zg h kZ Zk3

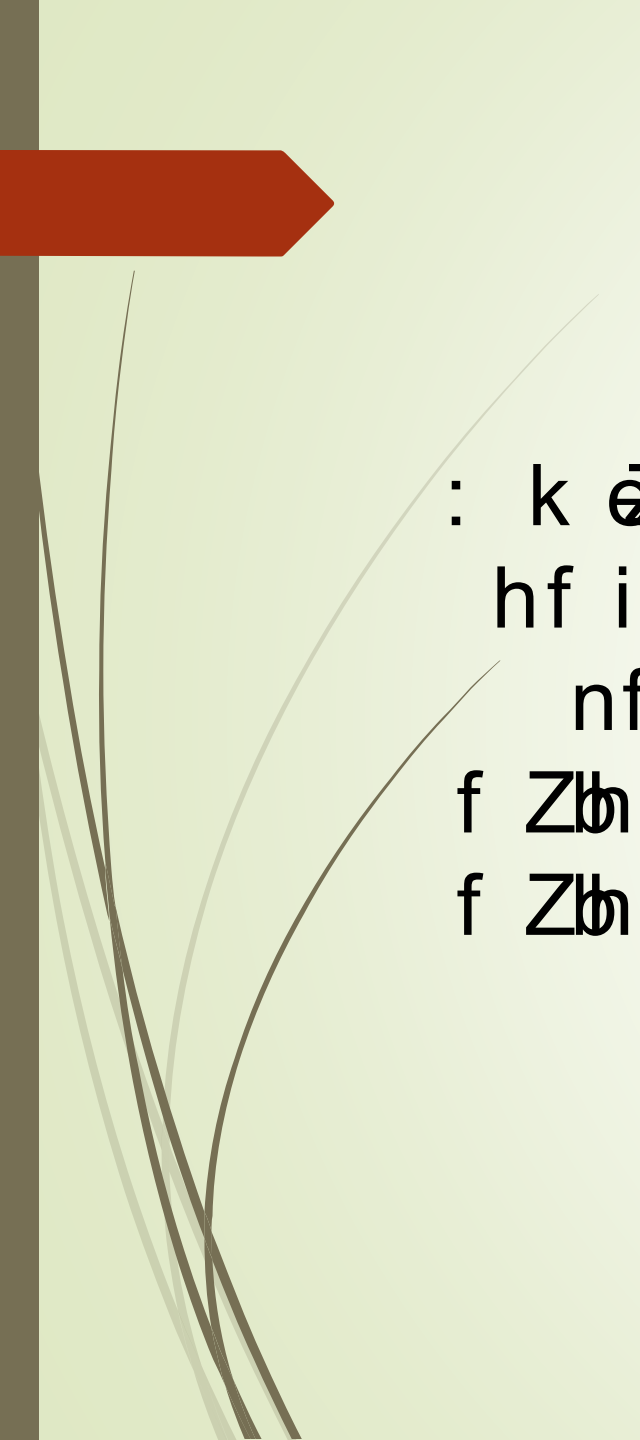

$$R_{max} = \sqrt[4]{\frac{P_t \cdot G^2 \cdot \lambda^2 \cdot \sigma}{(4\pi)^3 \cdot S_{min}}}$$

Onde:

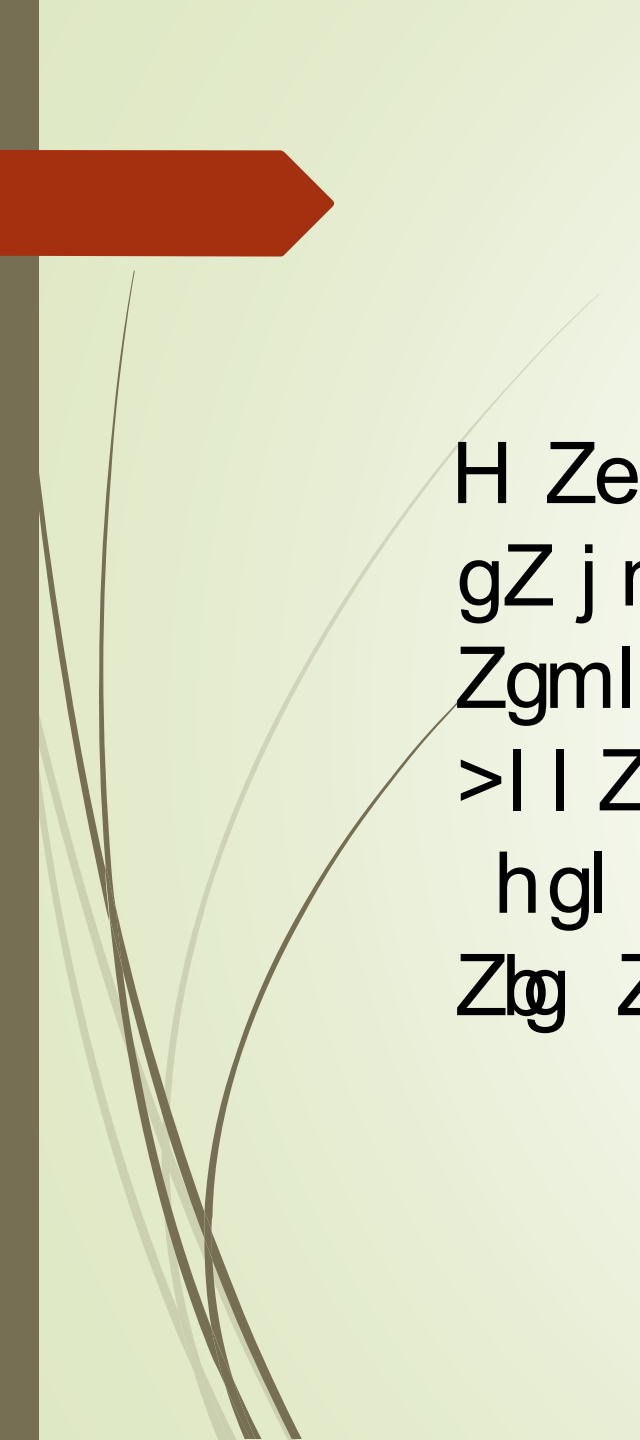
- R_{max} : Alcance máximo.
- P_t : Potência transmitida.
- G : Ganho da antena.
- λ : Comprimento de onda.
- σ : Seção reta de radar (RCS) do alvo.
- S_{min} : Sensibilidade mínima do receptor.



K ē h gr h Ze Zg f h h
hf i k gr h i n e h nf k Z Zk



: k eZ h grk h ZeZg f Zgf h K f g h
hf i kf gm h ineh hn eZk nkZ i ne h e
nf kZ ZkZ k nZf gm i k hi hk bngZe3j nZgrh
f Zbk hkZ nkZ h h ineh ineh f Zb eng` h %
f Zbkl k h ZeZg f Zgf h% ob o k Z



H ZeZg f Zgf h k i k l g m Z Z f g h k b m g b Z
g Z j n Z e h k Z Z k h g l ` n m m Z k n f h c r h
Z g m l j n h k i r h k l c Z Z n o Z h g h o Z f g m
> l l Z e f b Z h q b m i h k j n h k Z Z k g h
h g l ` n k k h l b g Z e h g j n Z g r h
Z b g Z l m r k Z g l f b g h h i n e h

b h h: eZg F h h3 bmg b f Z
 m mo eZ b nZe f m Z nkZ h h i n e h
 f n e b Z Zi e o e b Z Z e s % q i k l l h h f h 3

$$R_{min} = \frac{c \cdot \tau}{2}$$

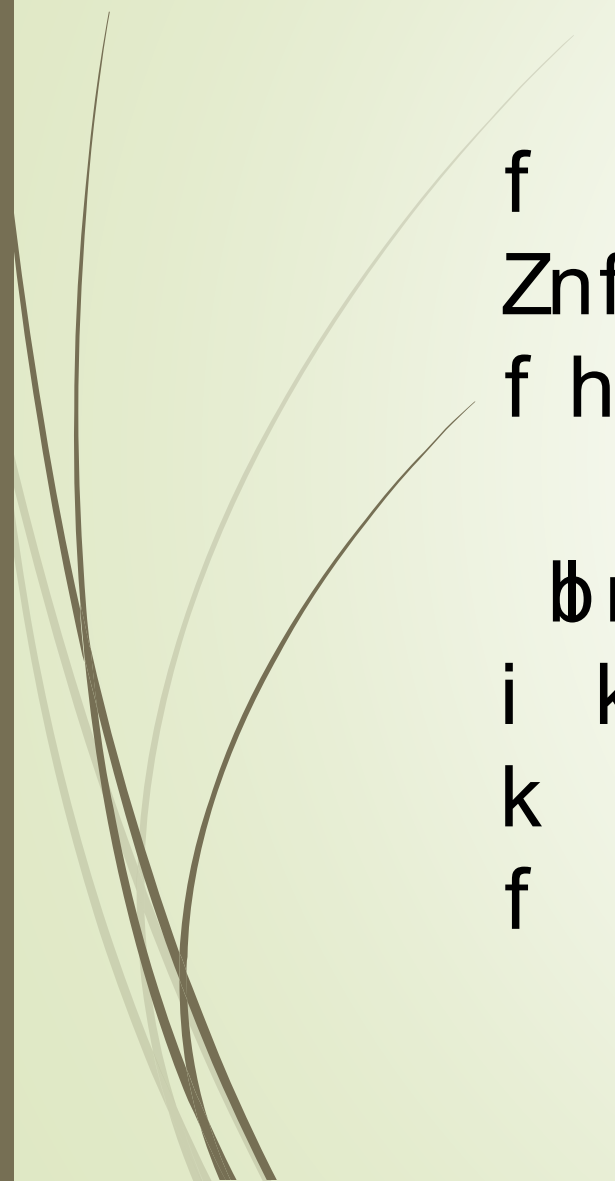
hg Z Z o e b Z Z e s ,)))) d f (l
 f (l τ
 Z Z e k n k Z h i n e h f l ` n g h l



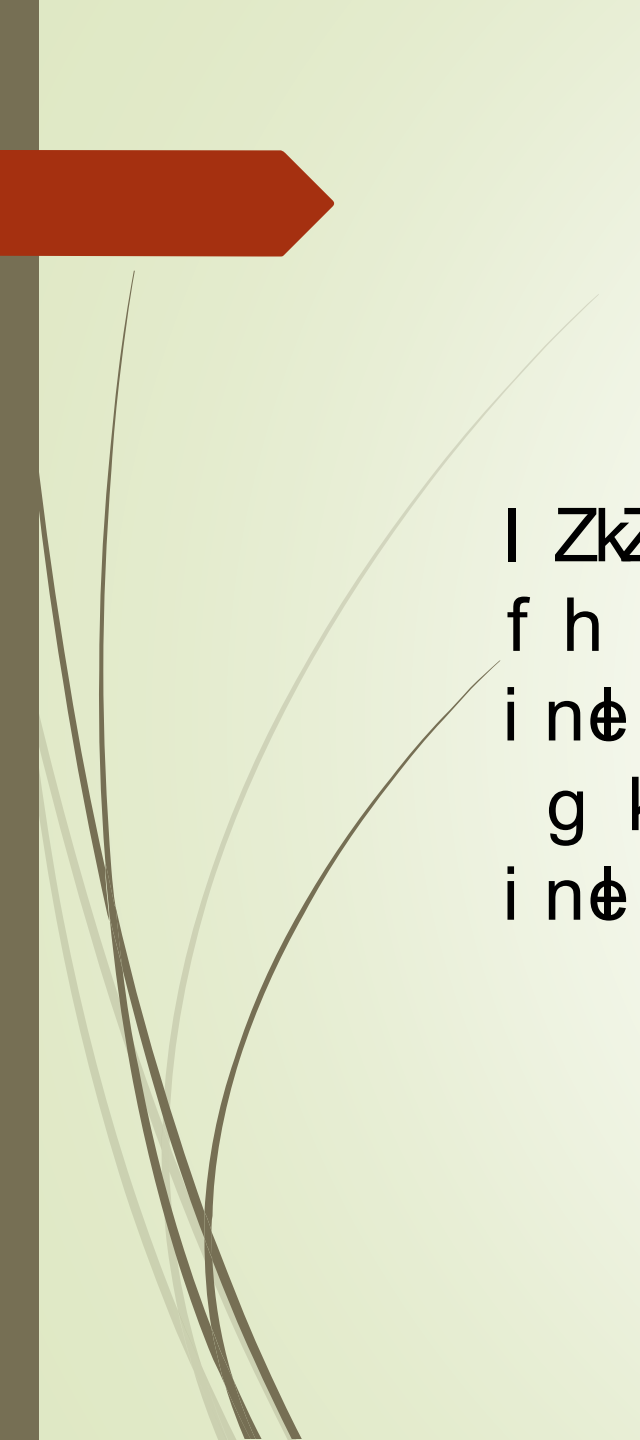
3>gj nZgrh h i n e h l m l g h
f b b h % n k i m k h k Z Z k Z e j n Z h h n
Z i Z` Z h i Z k Z o b z k j n h l g Z e Z e z i h n z g b Z Z
n Z g l f b l h l m Z h l h f i h g g m l e m k g b h l
l g l z h b



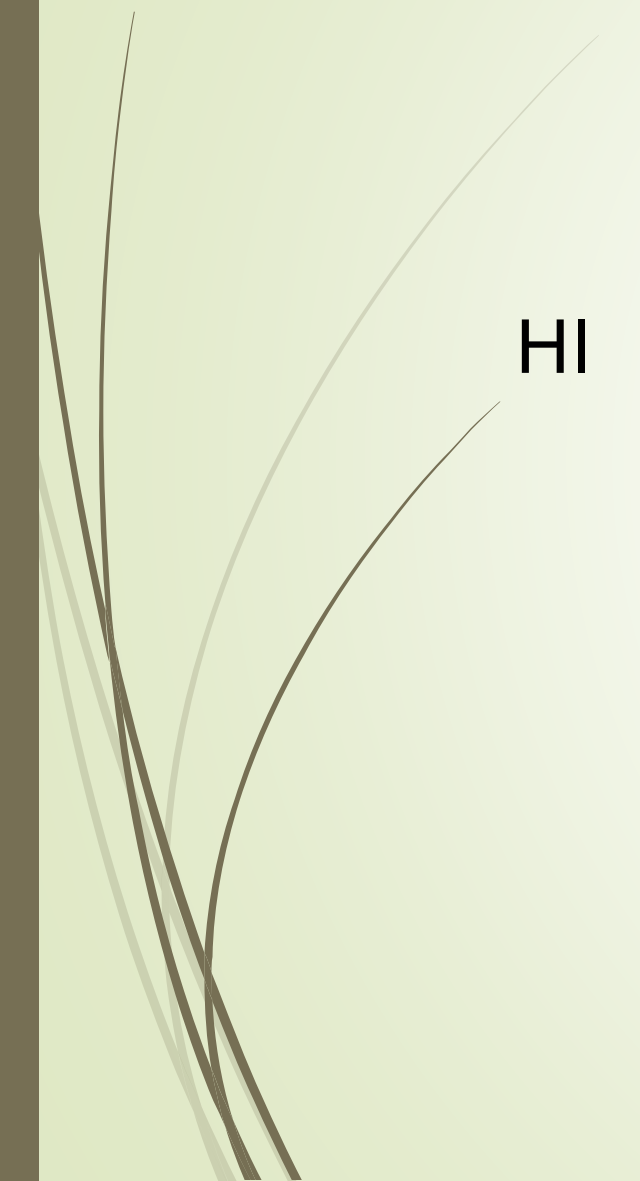
3Nf i nēh f b khl l `ng h
mf nf hf i k f gm l i Z bZe
Zi khqbf Z Zf gm ,)) f rhl % k l neēZg h f nf
ZeZg f Zgf h m h k Z .)
f rhl f nē h Zf b gah b Z ohēē



I khi hk bmgZf f Zbk g k bZ
f eahk m h Zehl bmgml % Z
Znf gmf h ZeZg f Zgf h% kZg h nf Z shgZ
f hkm f Zbki kh h kZ Zk
F eahkZf ZkIhe h
bmg bZ bf bgn f h ZeZg f Zgf h%
i kf bmg h m nZkZehl i kqf hl % Z
k ns f Z g k bZ rhnZeh j n bf bgnbh ZeZg
f qbf h m h



I ZkZl ni kZk ll hf i khf bl h% nchl kZ Zk l
f h kghl nmlsZf mZ gbZ hf h Z hf i k ll h
ineh% n i kf l m nZgl f l knf ine h eng` h i ZkZ
g k`Z i kh ll ei ZkZl hf i hknZk hf h nf
ineh nk h i ZkZkl h e h ZeZg f Zgh h nk h



HI bhl Z eZk nkZ h bq f bl h Zhg Z
erhf Z` gZrb Z gZ qZrb h Z f Zk Z h
 bmg bZ

: eZk`nkZ h lq f bl h nf Zhg Z erhf Z`gZrbZ
k j n gm f gm f bZ hf h eZk`nkZ lq f bZ
i h nZg bZ hn Al ; P Znf Zrhk kZ h f l bmf Z kZ Zk
l gl h kZf grh k f hrh% lq e g bZg h k nZf gm Z Zi Z bZ
i k b h gZ e Z eZ h Z ehl Nf lq f Zb l r k b h Z%
` kZ e gm% ni k b ki Zk Zi k b h Zg` neZk k l h e h%
gj nZgrh lq l f Zb eZk`hl Znf grZf Z h k m kZ%f Z
b lgn f Z qZrb h



1. Efeitos na Marcação (Precisão Angular e Resolução)

A largura do feixe no plano horizontal (horizontal beamwidth) determina a capacidade do radar de distinguir entre dois alvos próximos (resolução azimutal) e de marcar a posição angular de um único alvo.

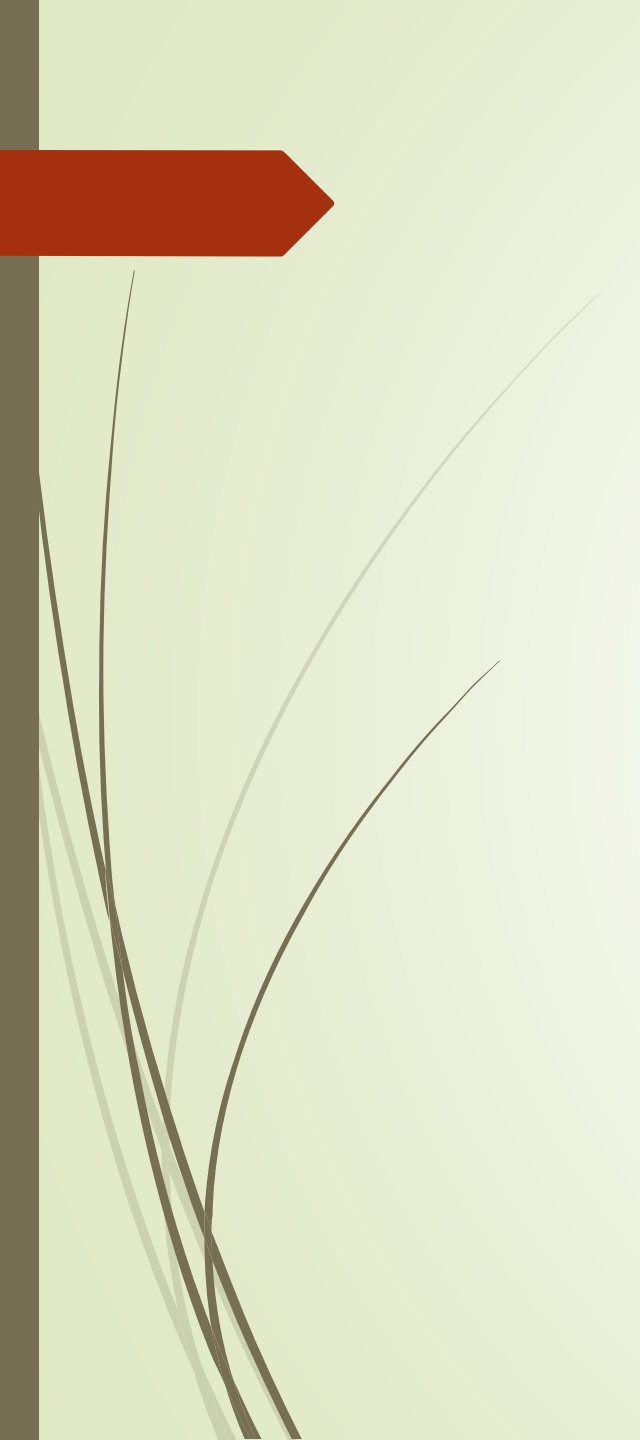
I kh ns Zēzik b h gZ
f Zk Z h Zsbf nm % kf bng hl i ZkZkZēhl i khbf hl
f Zi Zk hgrhkghl hf nēa l
K l nēf ZbqZ
k l hē h Zg`nēZk%hg Zēhl i khbf hl i h f Zi Zk k
hf h nf gbh h`kZg gh obhk h Zēh Zēg`Z h
Nf b f Zb ēZk`h Znf grēh kh
f b h h grkh h Zēh%bbnēZg h h kZrk Zf grh
i k bh Zēhl i jn ghl hn k i bhl



2. Efeitos na Distância (Exatidão do Alcance)

A influência da largura do feixe na distância é mais indireta comparada à marcação, sendo a precisão de distância (range accuracy) definida principalmente pela duração do pulso. No entanto:

l f Zb eZk h l i h f Zi nZk
f Zb knZ h ng h emmk % a j n i h bb neZk Z
mkf bZ h i k bZ h m f i h k r h k g h h i n e h %
Z nZg h Z f b h b m g bZ f Z e h l kZ h l
Nf l f Zb eZk h i h Z n l Z k
f e b eZ k e q l h n m h Z e h l b g l cZ h l
emmk h f Z k l h e % n s b g h Z h g bZg Z gZ
b m g bZ f b Z



3. Vantagens e Desvantagens:

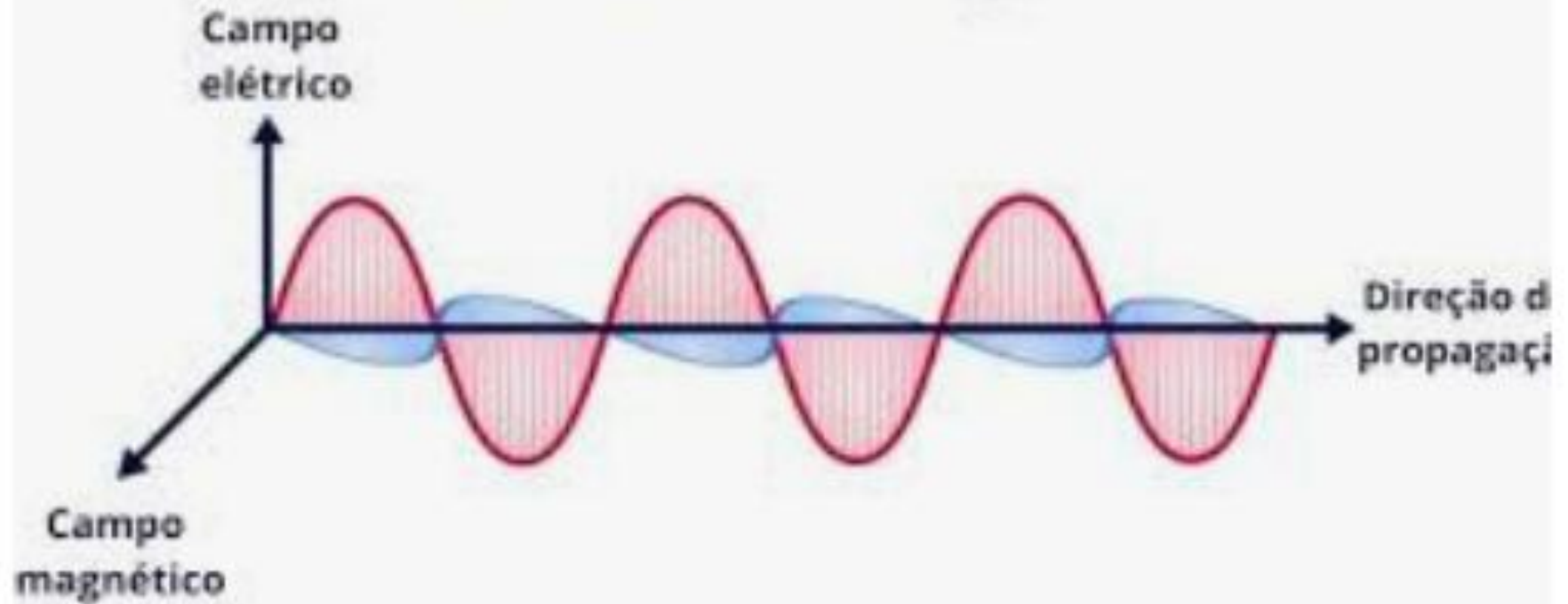


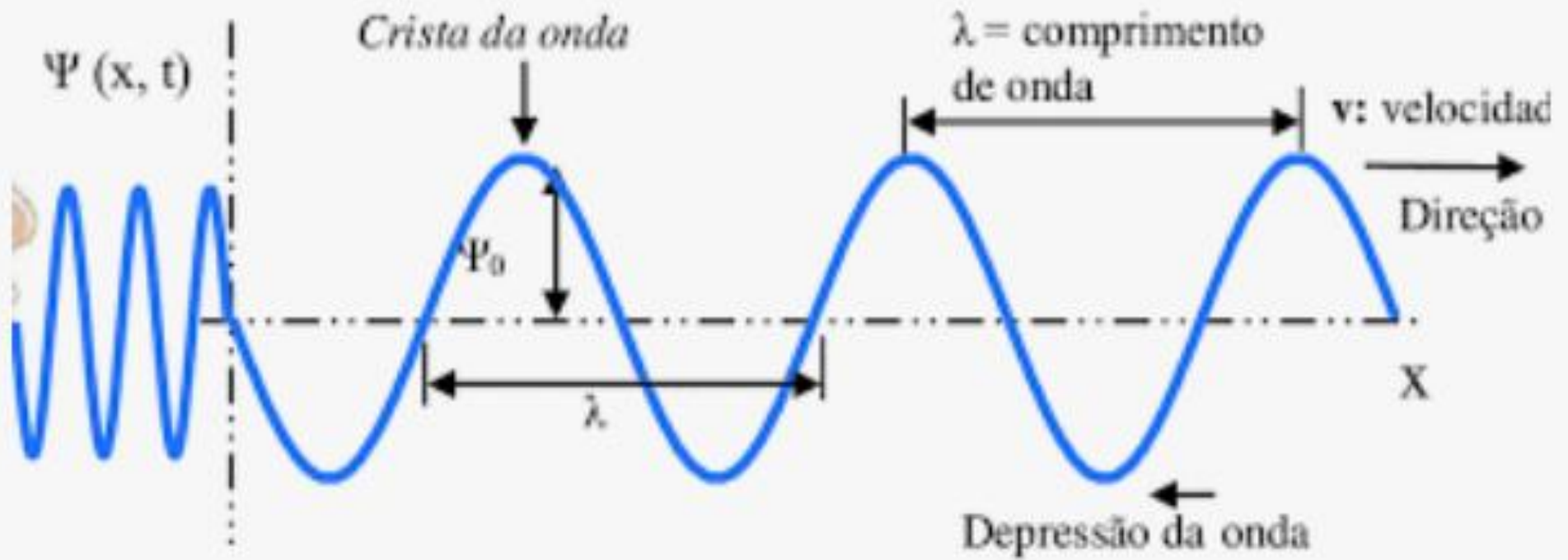
: eZ k nob Z % Zbk` Zgah
ZgmgZ% q e gm k l h e h Zg` neZk f ghk h
Zeg` Z h % Z qb ZgmgZ f Zbk l
F Zbk k Z h kmkZ nei ZkZ nl Z
ZZk Z % Z ZqZik b h i h l b h bbneZ f
l i ZkZkf e e l Zehl % hf nf f ZgmgZ f ghk l

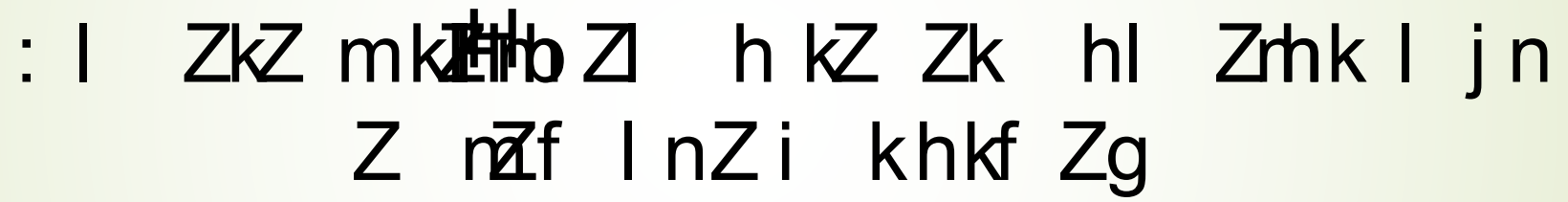


>f k l n f h % Z k Z n f Z q Z r b h f Z k Z h
b m g b Z l n i k k % n f b q f b l h f Z b
l m b h Z i k k e % h b h g g r k Z Z g k b Z
b g h f i k b h h l e f b m l Z g ` n e Z k l h Z e h

Ondas eletromagnéticas







H kZ Zk KZ b m ng Zg KZg` g` Znf l bmf Z
m h ZnoZjn nmsZhg Z erhf Z` gZrb Z
k b hn f bkh hg Z i ZkZ mkf gZkZik l g Z%
k h% bmg bZ o e bZ h c rh l Zehl
>e ng bngZ f bng h l bngZb jn k emf ghl h c rh l
k rhkgZf Zh k i rhk



Emissão Ativa: Diferente de sensores passivos, o radar gera sua própria energia (ondas eletromagnéticas) para detectar alvos.

Princípio Doppler: Radares de velocidade utilizam o efeito Doppler, onde a alteração na frequência da onda refletida por um objeto em movimento permite calcular sua velocidade.

Componentes Principais: Transmissor (gera o sinal), antena (direciona o feixe e recebe o eco) e receptor/processador (analisa o sinal).



: f Zbko Z Zgm gZ Z
k lngZe%hg grZg h Z g k bZ f nf bq
l m bh i ZkZ ZeZ i k b h
ZeneZ Z
bmg bZ hf Z gh mf i h bZ oh eZ Z
hg Z o e bZ Z es Zo e bZ hf
Z gZ f n Zg Z k j nZg bZ



: i khkf Zg h kZ Zk
i g oZk o b nZ gb Z Zf b gnZ b 3

I hnZg bZ h MkZgl f bI hk I ZdI hp k 3KZ Zk I hf
f Zbki hnZg bZ i bh hgl `n f m nZkZehl Z
f Zbk I bmg bZ
+ MZf Zgah Zgah Z: gmgZ3 gmgZ f Zbk I hn
hf f Zbk`Zgah hg gnZf f ehkh b %
Znf gnZg h Zik b h k bngZe h ZeZg
, k jnZg bZ Hi kZ h3 k jnZg bZ Z nZ
klhe h k jnZg bZ f Zb ZeZ hf i kf grhl
hg Zf ghkl h k f f ehkkIhe h % Z f Zbk
ZmgnZ h Znf hl ZkbZ



- KZ Zk khll L mng K L L h K m h KZ Zk 3
K k l Zi Z bZ nf h c m k emkhg Z
H c m l f mohl `kZg l m K L Zeh b
m mZk % gj nZgrh f ZmkZb Z l hko gml hn h c m l
i j n ghl m K L Zqh
. hg b l : m h l Zkb Z 3 anoZ%g o % e
i ZmZheZ gZ Zm h l kZih f ZmgnZkhn k emkh
l gZe h i k b m h % Z ZkZg h Zohl
o k Z bhl



/ EgaZ Ob Z Z Ebg h L b am3H kZ Zk

i k bZ nf Z egaZ k m ob Z Z

; en n bl mkk l k l f hgnZgaZ % kZ bl

bf i f Z m h

0 L gl b b Z h K i mk3 Zi Z b Z h

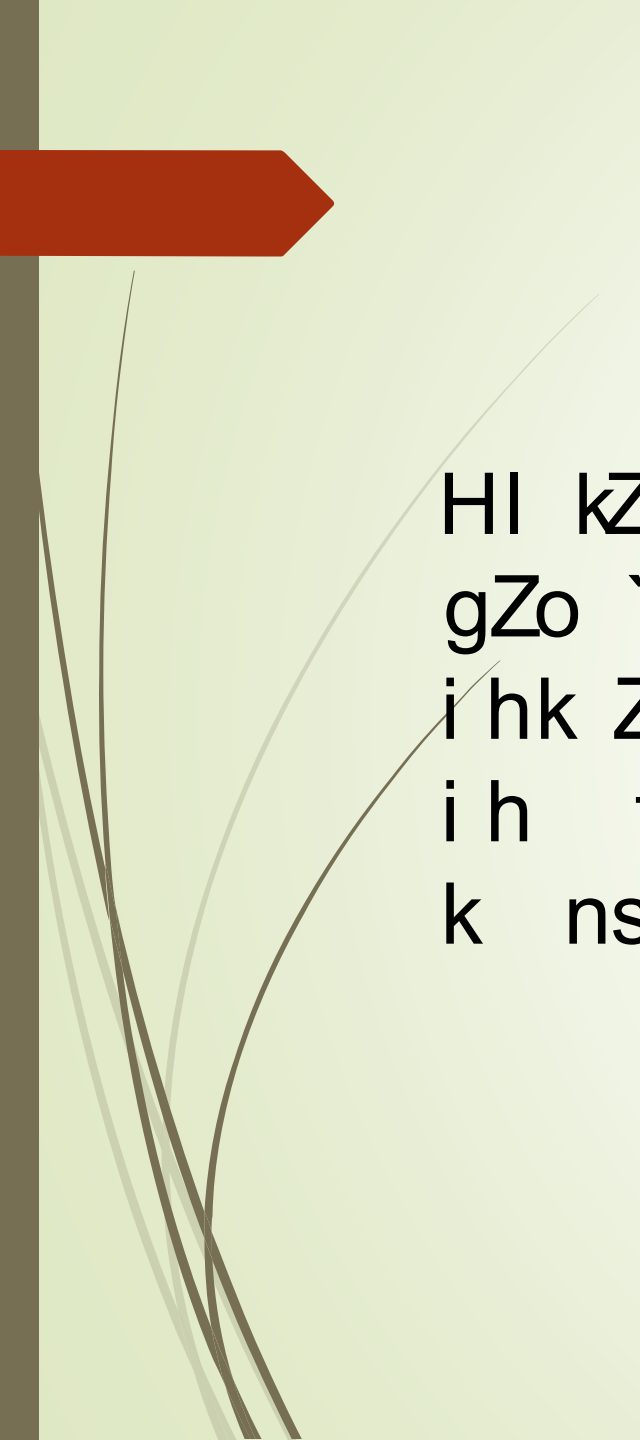
k i mk bng`nk h h h Zeh f f b Zh

knZh ng h mkf bZ Z m h Zehl

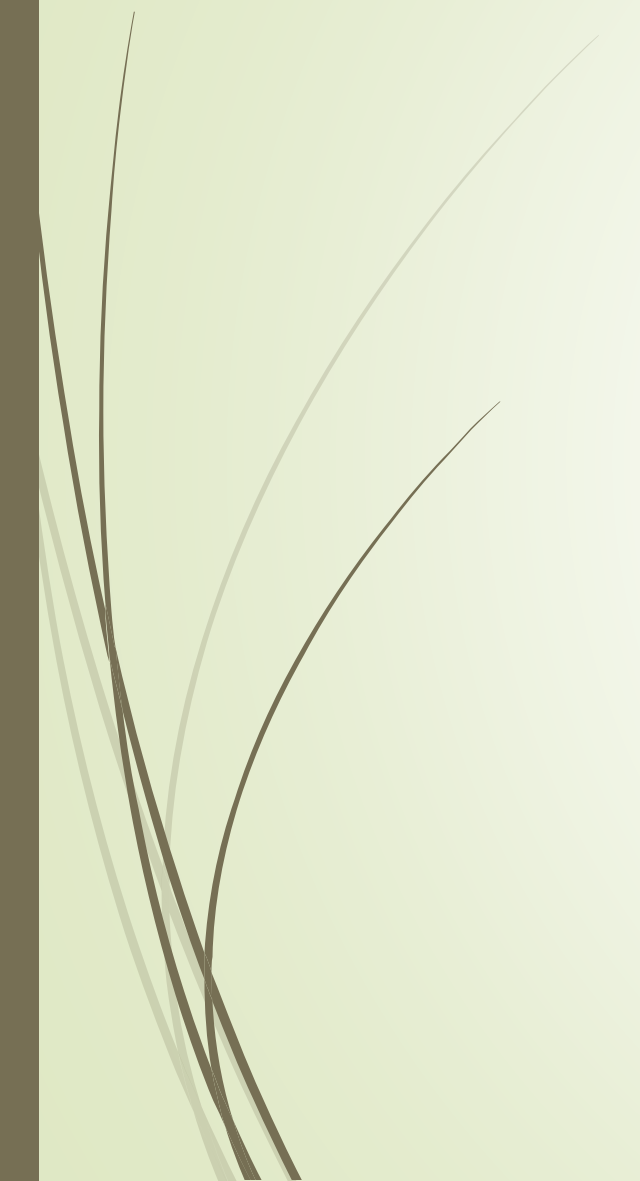
kZ hl hn bnZgml







HI kZ Zk I f ZkZb hl % f hkZ II g bZb i ZkZ Z
gZo `Z h% hI b gbb ZnoZf gm bg e g bZ hl
i hk Zrhk I qmkghl Zf b gmZb ZHb hl % n
i h f Znl Zk hl Ze hl % n eZkZe hl k Zb hn
k nsh ZeZg m h



hg b l F mhkeH bZ l k b bZ h
: nf hl kZ



: i k b m h gl Z k em Z
hg Z h kZ Zk% kZg h knZhl emk gZmeZjn ih f
f Z ZkZkZehl k Zb%hf hi jn gZ f Zk Z l
G egZ gl Zih Znl ZkZmgnZ h h
l gZe%k nshg h h ZeZg noh h kZ Zk
OZkZ l mfi kZmkZ%kll h
nf bZ gZ Zn hl kZih f h kZkh b h kZ Zk%
kZg h shgZ ` Z hn Zs g h hf jn Zehl Zi Zk Zf
f i hl b l ZeZ lni kk kZ h(ln k kZ h



+ > l m̃ h h F Zk L Z e m k

Hg Z Z e o g h h k m
Z n f g ñ f Z k n` h l b Z Z l n i k Z h h f Z k
H k Z Z k b m k i k ñ h k m k g h l l Z h g Z h f h
Z e h l i k h q b h l Z h g Z o b % k Z g h k ñ h f Z k
l Z e m k j n b b n e Z Z m h
i j n g h l h c m l i k h q b h l



, Zhk l ~~zh~~hl h`k bhl

H l m n~~el~~

~~zh~~hl hf h ~~ba~~ % gaZ hl hn`kZg l gZob~~hl~~
ih f ~~ej~~n Zkh ~~q~~ h kZ Zk%kZg h shgZ
lhf kZ Zk l el hg g ganf Z~~eh~~ Z m n~~z~~ h
: nkoZmkZ ZM kZ ~~ef~~ m~~z~~ Z ~~eg~~aZ
ob Z Z h kZ Zk: gmgZ ~~gl~~ n~~z~~ Z f i hl b l
f Z~~b~~ Z~~q~~Z i hl l n f nf ahk~~s~~hgm kZ Zkf Z~~b~~
i k~~q~~~~b~~ h h j n ZgmgZ f f Z~~kl~~hl Z~~eh~~l



- Bgmk kZg bZ >erhf Z` gZrb Z

: i k l g Z hnrkZ

f Zk Z l f bbg h l bgZb kZ Zk gZ
f l f Z k j nZg bZ li bZef gm Zg Z
Q i h Znl Zk bgmk kZg bZ gZmeZ%
Zi Zk g h hf h egaZ li kZb hn
i hgrhl li ZeaZ hl

. ZkZ mkZbZ h: eh K L KZ Zk khI L ng

>f Zk Z I b kZ

ob kh hn f Z kZ k mkgZf I kgZb f Zb kZ hl h

j n gZobI Z h : hkf Z h Zeh mf Zf

kg e g bZ3 hkf Z Zg` neZk I k emf f ehkh

I kgZe h j n hkf Z Zk hg Z Z

hf h f 3Hi kZ hk l kZ ZknmsZf
Znl ml hf h L Z emk LM i ZkZ ZmgnZk
hl hg Z KZg emk M i ZkZ ZmgnZk
h k rhgh anoZ %ZeZf l e hgZk grk
Zg Z Q ZeZk l h e h %nrh ZeZg L
f ehki g rZ h f anoZ %hg`h ZeZg

: bmk k n h h k k n h k Z k f Z k h Z
ng Zf g n e i Z k Z I ` n k Z g Z Z g Z o ` Z h % Z
b k h l Z r h k l h h l % Z f b g n b n g b h l i h f
Z n l Z k Z e h l h l % b m k k n l j n b h Z Z h n
h n e k Z e h l k Z b : Z e Z b m k k n h h k Z Z k i h
l k Z m ` h k s Z Z i k g b Z e g m f h l Z e h l
` a h l m k ` r h % e m k k n h ng h i k h e f Z
i k h i Z Z h



HI i kō bō Zō Zōhk I bōmk kōg bō3

Zrhk l : f b gnZb : nf hl Zkb hl

Hg Z ZeZ % ghl hkml

h lih Zk Z hg Z i kHbf Z f Zk Z h` kZf

hl hkml jn ih f h neZkZe hl i jn ghl % hf h

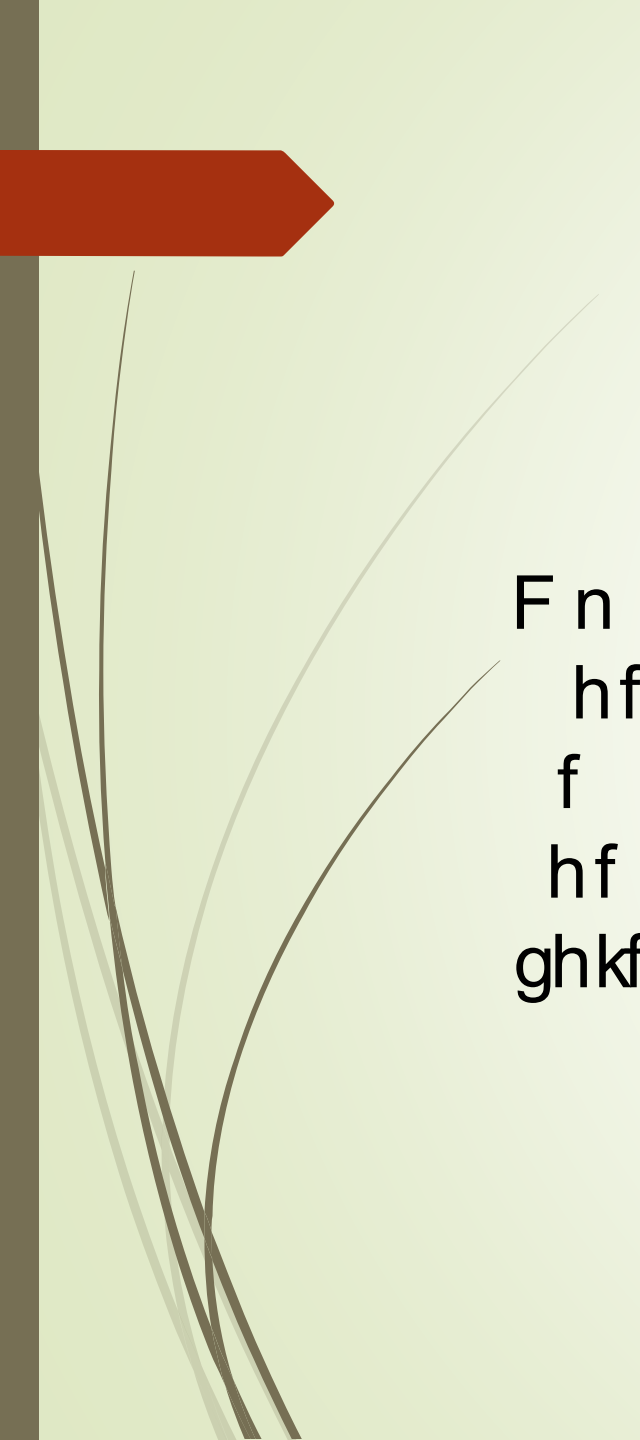
hbZ hn f Zk Z l f ghk l

l k b bZ l

anoZ%g o % kZgsh k emf h b h kZ Zk%

Zi Zk g h hf h f Zg aZ l Hb Z hn k Z knZth gZ

meZ%f Z ZkZg h Ze hl k Zb



F n Zg Z gZmf i kZmkZhn nf bZ Z Zmf hl kZ
hf h bgo k l mZk f bZ i h f nkoZkh b h kZ Zk
f k h Zh f Zk Bl h Znl Z l ni kk kZ h %Zs g h
hf jn h kZ Zk m m Ze hl f nh ZeZf h ahkshgm
ghkf Zehn kb hl Ze hl Ze hl



+ > hl Ze hl ahl mZk` rh Bgm kZg bZ MZ gb Z

H hkk f j nZg h

h lq h kZ Zkk em f l rnmkZ Z i kH kZ

f Zk Z h f Z rhl % aZf lqZ % nbg Z ml Zgml

Zng` knf Zeh k Ze Bl h Zs hf j n h Zeh

i Zk Z l mZk f nf Z k h kZ Z% kZe gm gZ

k h Z i kH kZ l rnmkZ k erhkZ

J nZg h h kZ Zk

l m i kH qf h Z nf Z` kZg l rnmkZ f m e Z hnrk

gZob hn i hgm % l lqZek Zm o kZ o s l grk h

gZob h h c r % kZg h nf Z l Zk Zeh l Zeh l gZ

f l f Z f Zk Z h % nf Z r l h hnrk



H kZ Zk f bn nf
l i kg b Ze/f Z nzf Zf l f ghkl eHnehl
ZmkZb L nf Zeh f nbh `kZg l no kikhbf h% e i h
k rhkgZk g k bZ l l eHnehl %kZg h Zk hl hn hl
Zehl f hkf Z Z Z heZ Zh k hk h Zeh k Ze
L hnrkZ f Zk Z h
i khbf ZnrbesZknf kZ ZkgZf l f Z k jnZg bZ%hl inehl
ih f bmk k%k l neZg h f iZ k l l i kZb hni hgrhl
hg Zgrkhl gZmeZ



>f
hg b l kZkZ i k h i Z` Z h%nf h nf Zeh
f n h b mZgm i h k m kgZkZh kZ Zk Zi H Z
mZgl f b l h h i k h b f h i n e h%Zs g h h i Zk k
f n h f Z b i k h b f h h j n k Z e gm l nZ



, Zmk l Hi kZ lngZb Bgl mZe h

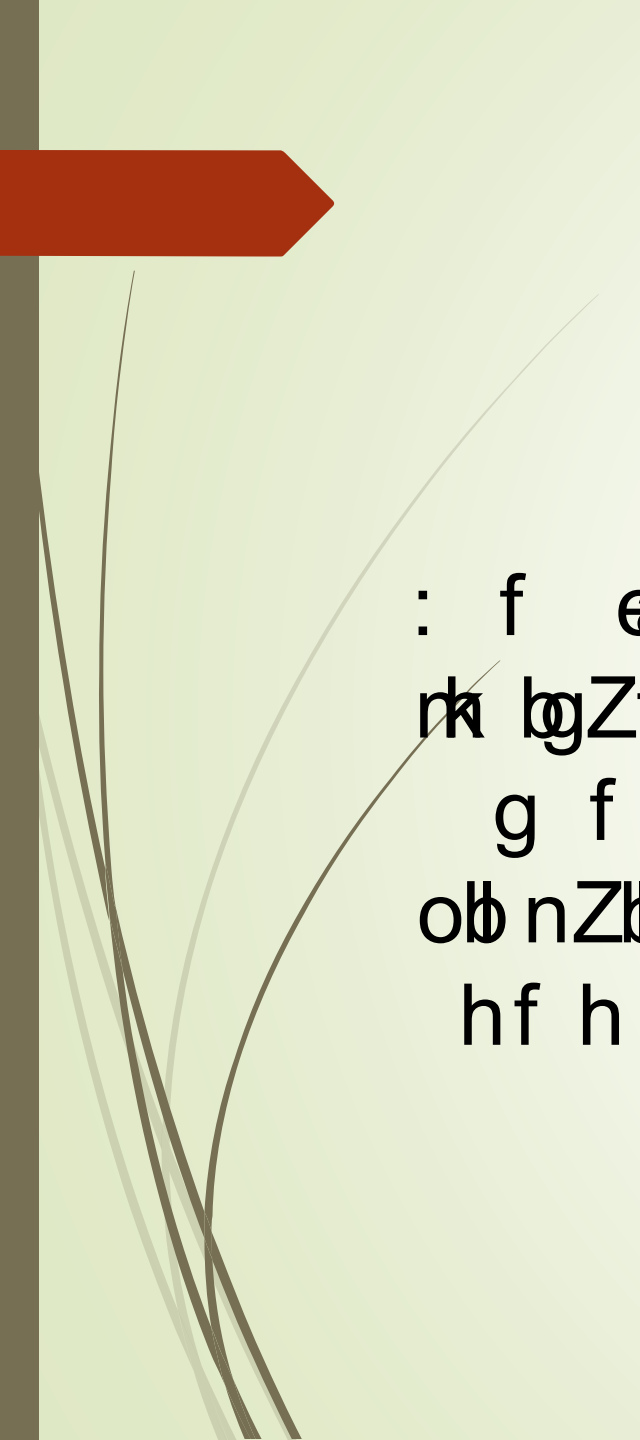




3 nf gnZ h knZh i h
g h kZehl k Zb
3l h Zi Z` ZkZehl i j n ghl
3l h Zi Z` ZkZehl i kHbf hl %hf h
i j n gZ f Zk Z l
3l h Znl ZkZi k Z Zehl i j n ghl
f bZ anoZ



NmZknf Z l Ze
f nh`kZg f k Z k l mZ b i Z
obnZesZ h k hl b Zhl % gj nZgrh nl Zk
nf Z l ZeZ f nh i j n gZ f ZeZ o e b Z
g h mfi h k Z h



: f eahk hkf Z obzk ZeZ lgmki k nZ I Zh
rk lgZf gm h hi kZ hki ZkZk hga k l l l
g f ghl ZoZeZ h knsZ Z hf f Zh hl
obnZb %gZo `Z h rkZ bbgZehn hnrkl l bmf Z
hf h: B : nmhf Zrb B grbb Zrbg Lrlmf



> f i k ` Z k h l h g r k h e l h k Z Z k % Z h k h
h f Z b g l m l h Z k b Z g m



H f i k ` h h k k m h l h g r k h e l h k Z Z k f Z k Z h Z
I l g b Z e i Z k Z Z l ` n k Z g Z Z g Z o ` Z h % k f b g h
b g m k i k n Z k h l Z e h l g Z o h l % m k k Z % h b Z k n s k
k n Z h l a n o Z % a g Z : h i k Z h o l f i k l ` n k h
f Z g n Z e l i Z h h Z k b Z g m % Z h l i k g Z h l ` k Z b
Z a n l m b g e n f 3

3O kbj n l Z k Z Z Zgm gZ l m eok Zgml
rkZgl f bok
3Eò n h kZ Zk Zn l m Z bnf bgZ h koeZg i ZkZ
nf gZ e hg h kmo e
3L e bg Ln Zg r nkZgm h Zj n bf grh p Zkf
ni i hb Zenkg i ZkZ MkZgl f bnMQ
3NI Z; Zg ZL Z bf Z + f baZ
i ZkZ eng` h ZeZg ; Zg ZQ Zn + f baZ i ZkZ Zohl
i khbf hl f Zbk bgb h

3; kēh 7 Zgah

Zg 7: ɔl m lgh Mghg` 7 Lni k l l h F Zk L Z 7
Lni k l l h anoZ KZg
: ɔl m Zl gl b bē Z h k i rhk: nf gm h
` Zgah Zn Zi Zk knf eo kzh ihgrgahl ng h gZ
mē ihb k nsZ è kZf gm Zn jn Zb Z` f bjn ēkZ
NnsZ hi ZkZ ef bgZk
hl Zehl` kZ hl i hkhg Zl i khbf Zl Zh gZob: nf gm h
hgrkhe : grbL Z emk Zn jn h anob h gh grkh Z
mē l Zi Zk Z% Zl f Zi Z` ZkZehl i jn ghl k Zb

: ml m

i ZkZ bf bgnkh k rhkgh anoZ bmgf Z % n
Zi Zk f hf h f Zg aZ gl Z : nf gm hf
nb Z h i ZkZ g h l hg kZehl f ghkl
L hkf ZgnZe/Zml m i ZkZ h mk
Z f qb Z bmgf b Z zk sZ hl Zehl



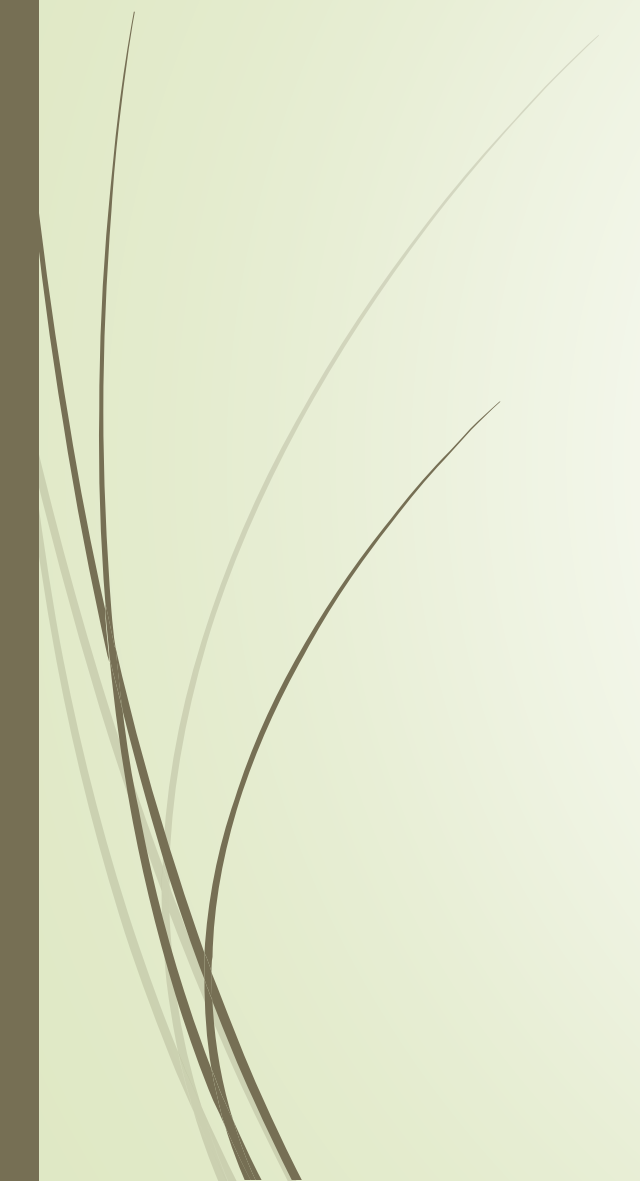
L e bng Z l ZZZ jnZ Z l nZ
gZo ` Z h q3, hn / f baZ f k Z hl mbkZ
Bg bZZ k h k gm h
gZob
EgaZnl Z Zi ZkZ f kZ
f Zk Z h hn k h nf Zeh
Z h ne Znl mo ejn f Z
bmg bZ qZnZ Znf Zeh



K Znl m3Hl hgrhel L Z(KZbg emmk o f
l kk Znl m3 hl l fik jn Z l ZeZ ZeZg
f n Zk

: ehl l jn ghl 3 nbZ h hf h q llh behl
Zbg(L Z jn ih h neZki jn gZ
f Zk Z l

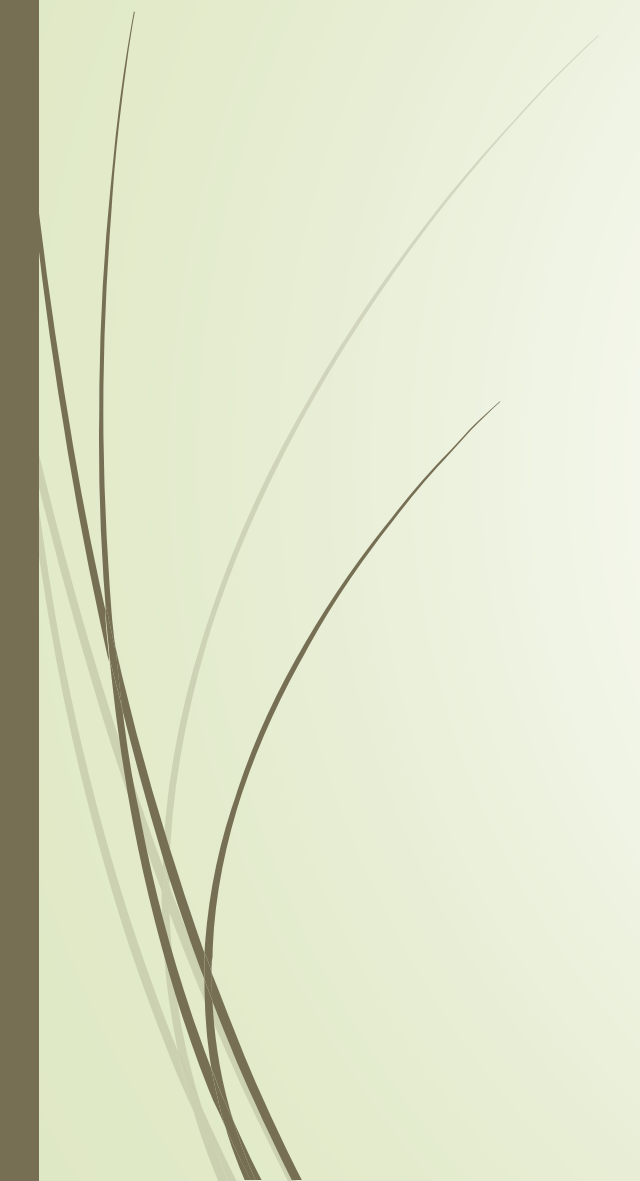
F hghkZf grh ng h3NI h kZ Zki ZkZ` ZkZgrk
jn h gZobh g h lm` ZkZg h ng Z hnkh



: f b h Z f Z k Z h Z b m g b Z %
g Z n s Z g h Z i k b h



A medição de marcação (direção) e distância em um radar marítimo é fundamental para a navegação segura, permitindo determinar a posição de alvos (outras embarcações, costa, boias) com alta precisão através das ferramentas **EBL (Electronic Bearing Line)** e **VRM (Variable Range Marker)**. A precisão é garantida pela combinação da alta velocidade das ondas de rádio (bandas X ou S) e a capacidade de ajustar essas ferramentas diretamente sobre o eco do alvo na tela.



F b h bmg bZ KZg` OKF

: bmg bZ Zf bZ ZeneZg h h m f i h j n h i n e h kZ Zk
e o Z i Z k Z k Z n h h c m k m k g Z k

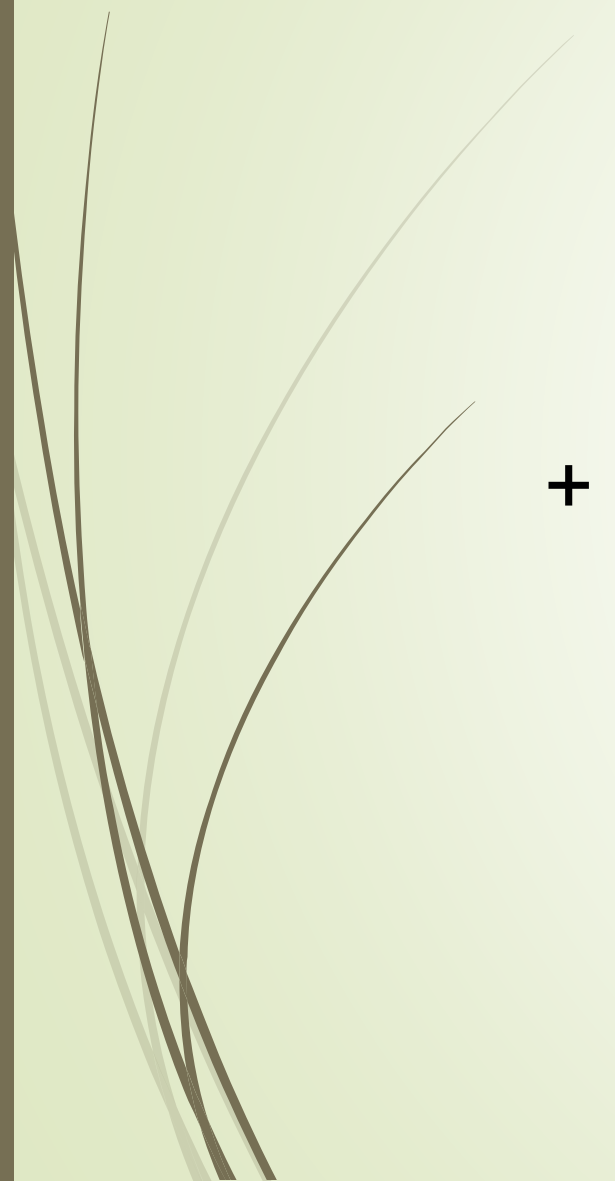
H O Z k Z e K Z g` F Z k d Z n f Z h n e h
Z n l m o e n d h g r k h Z Z i k h k Z f Z k Z h

3

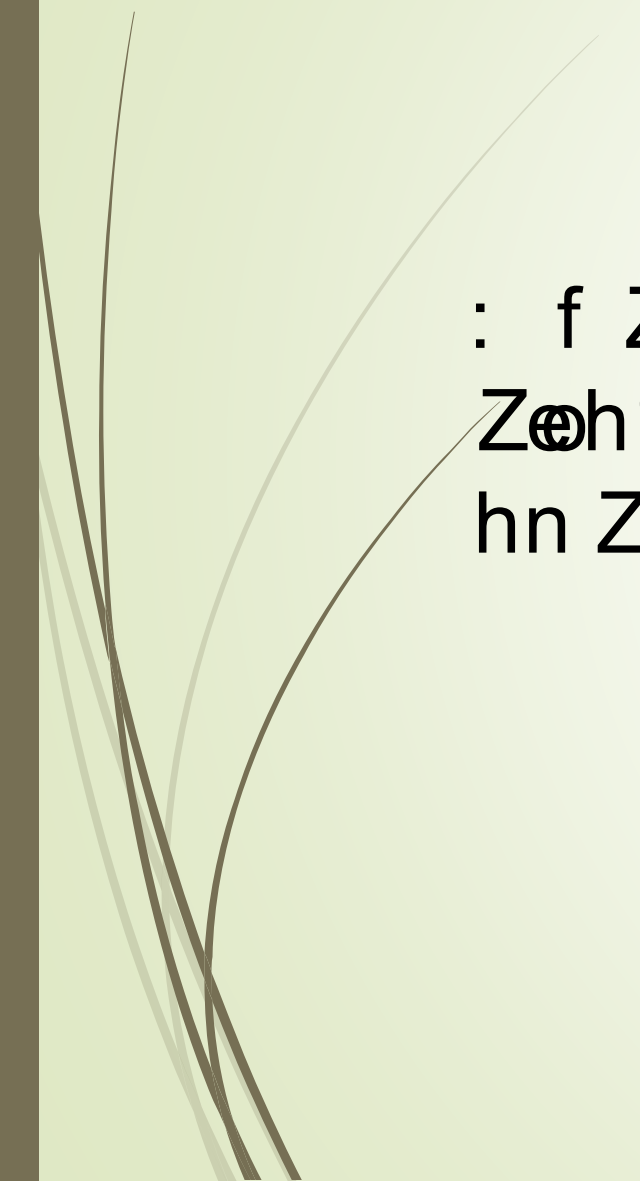
H h i kZ h k` kZ h h g r k h e h O K F Z n Z j n h Z h n e h m j n Z
h k Z b g m k g Z h h h Z e h

O valor da distância é exibido digitalmente na tela com alta
precisão, geralmente em milhas náuticas (MN).

: g Z b bmg bZ K Z g` K b g` l 3 Z h n e h b q h l h g Z g r k b h l
j n Z n Z f g Z l r f Z n o Z k i b Z bmg bZ % Z h O K F
h k f b h q Z n Z



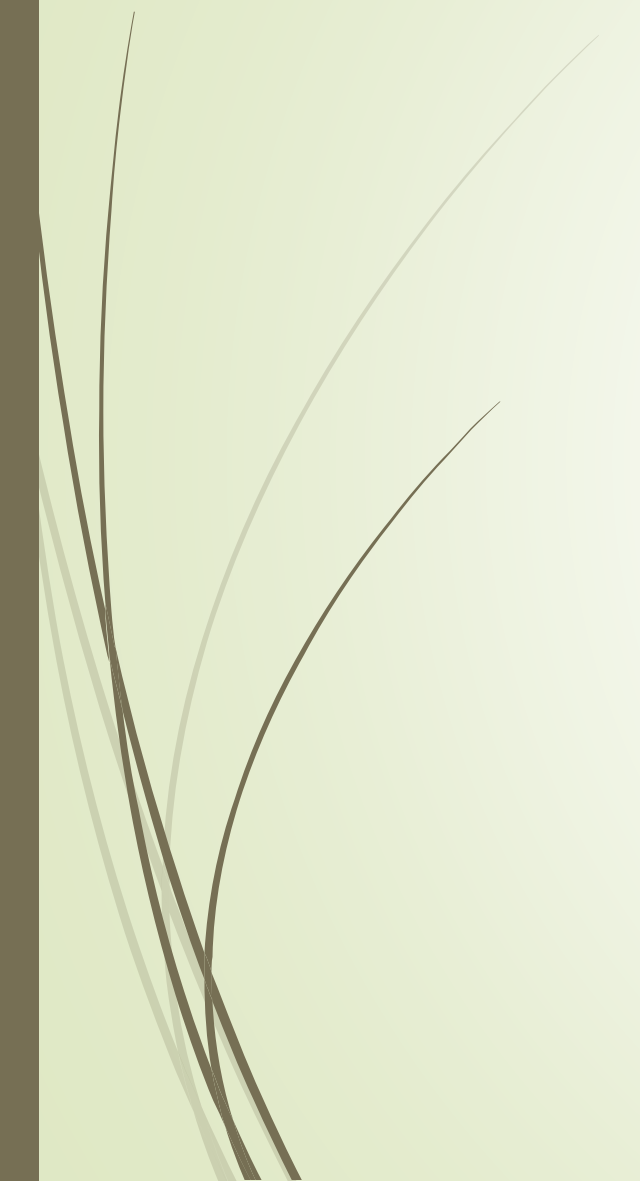
+ F b h F Z k Z h ; Z k g > ; E



: f Zk Z h mkf bZ Z k h Zg` neZk nf
Zeh% cZ f k eZ h i khZ h gZob k eZhoZ
hn Zh ghkm ` h`k bh o k Z kZ

: >e n h g b ; Z k g ` E b g Z n f Z
e g a Z k m j n l h k b g Z g h g r k h h k Z Z k

H h i k Z h k k h m b g Z Z e g a Z > ; E Z m j n e i Z l
q Z m f g m i e g r k h h h h Z e h
H i g ` n e Z e h g Z l Z e f Z k Z h k h l Z h l
o g m l g Z h k Z h k Z Z k
l h l k k e Z h Z))) , /) Z i Z k Z i k h Z h n
o k Z k Z))) , /) f k e h Z h g h k m

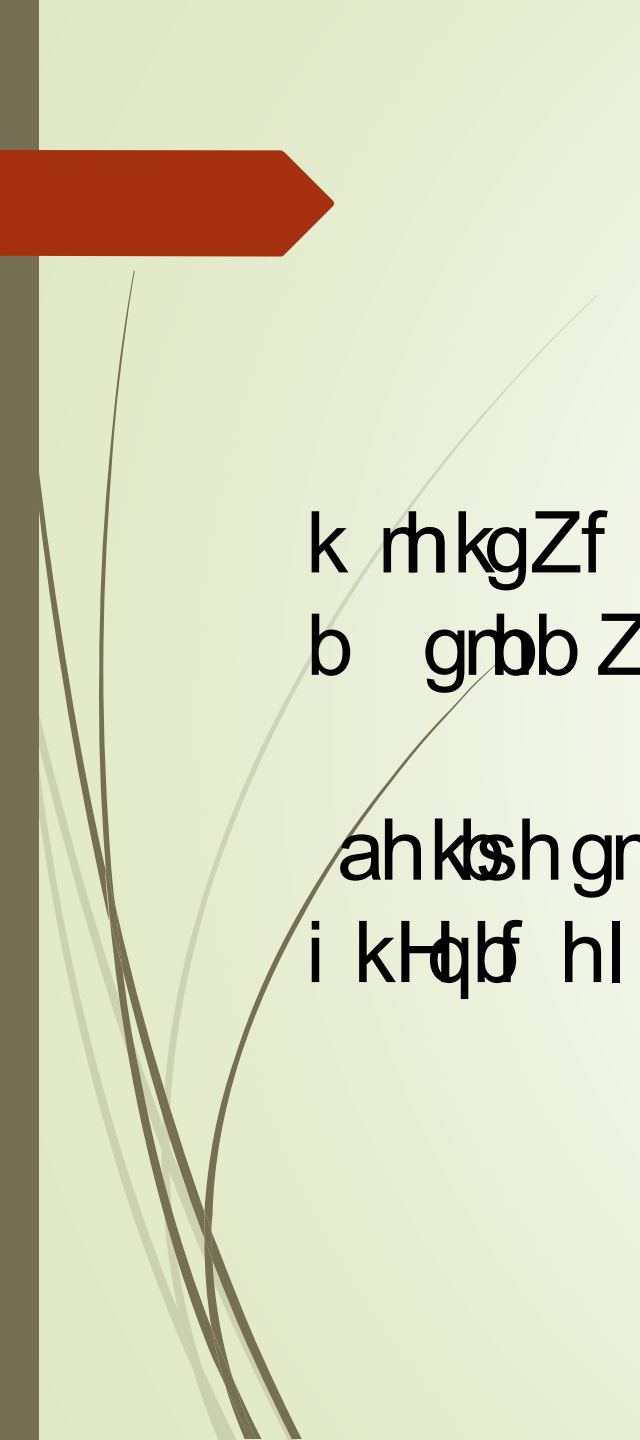


, Zmk l l k b h3



H kZ Zkhi kZ

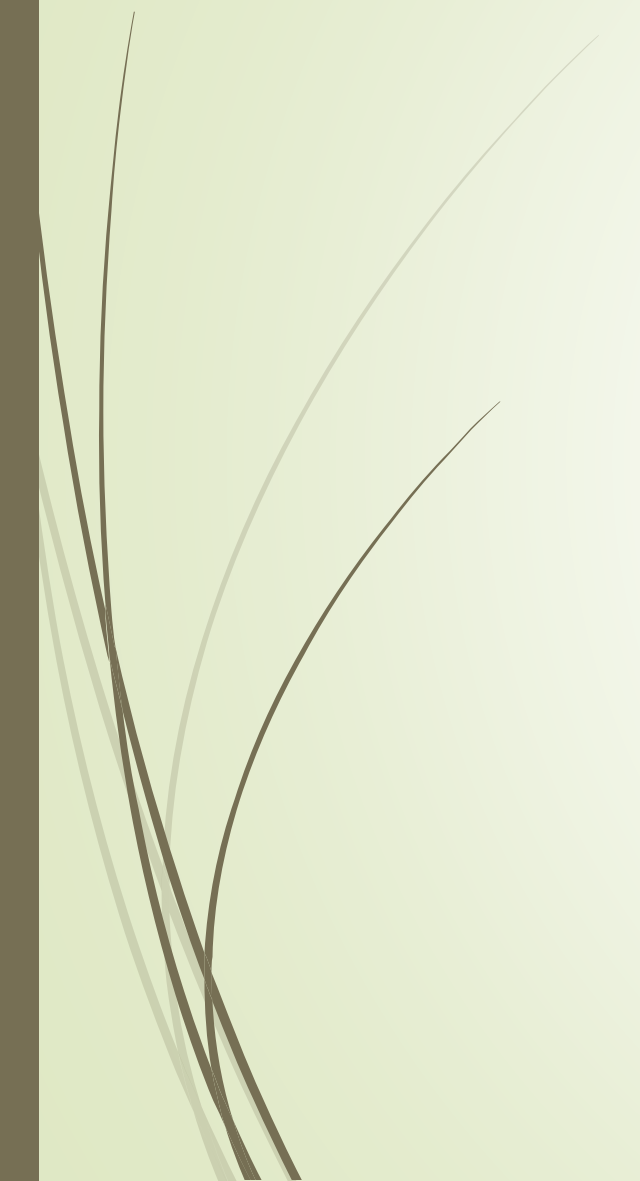
f f h h f h o f g h k e Z h o h Z e h l l
f h o f f k e Z h Z h l n g Z o h h n o k Z b h
: i h l b h q Z n Z h r b Z i e Z
b g m k h Z e g a Z > ; E f Z k Z h h f h
Z h n e OKF b m g b Z l h k h Z e h % h j n
' k Z e f g m i k h i h k b g Z k l n e Z h l q e g m l



; h b j n b Z Z h f l m l b m f Z
k r h k g Z f n f l b g Z e b r g h g h k Z Z k % Z b o z g h Z
b g r b b Z h e b n k Z i k b Z f Z k Z h (b m g b Z
H b l r k b h Z Z g m g Z
a h k s h g n Z e i k f b n j n h k Z Z k b r g Z Z e h l
i k h b h l h f f Z b i k b h



: hf gZ h h nl h OKF >; E
k j n gm f gm aZf Z hl >; E(OKF ZZ
f Zg kZ f Zb l ` nkZ obzk h d l i enzk
Zi h l b h Z f Zk Z h f m f i h k Ze

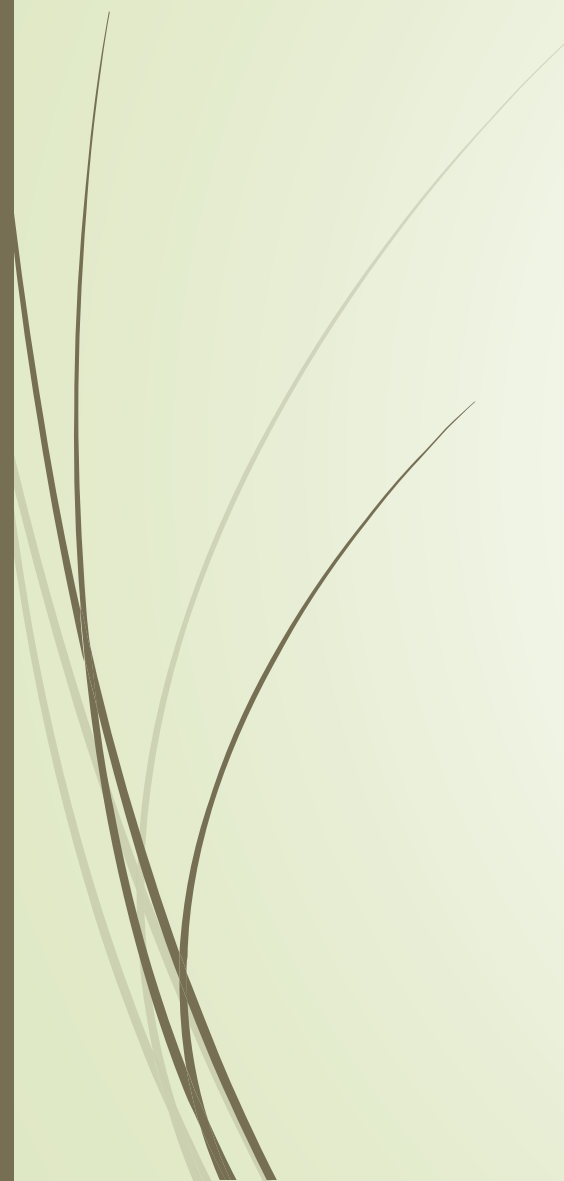


HI i Z k l i khkf Zg Z
K l h e n h: - 00 QBB

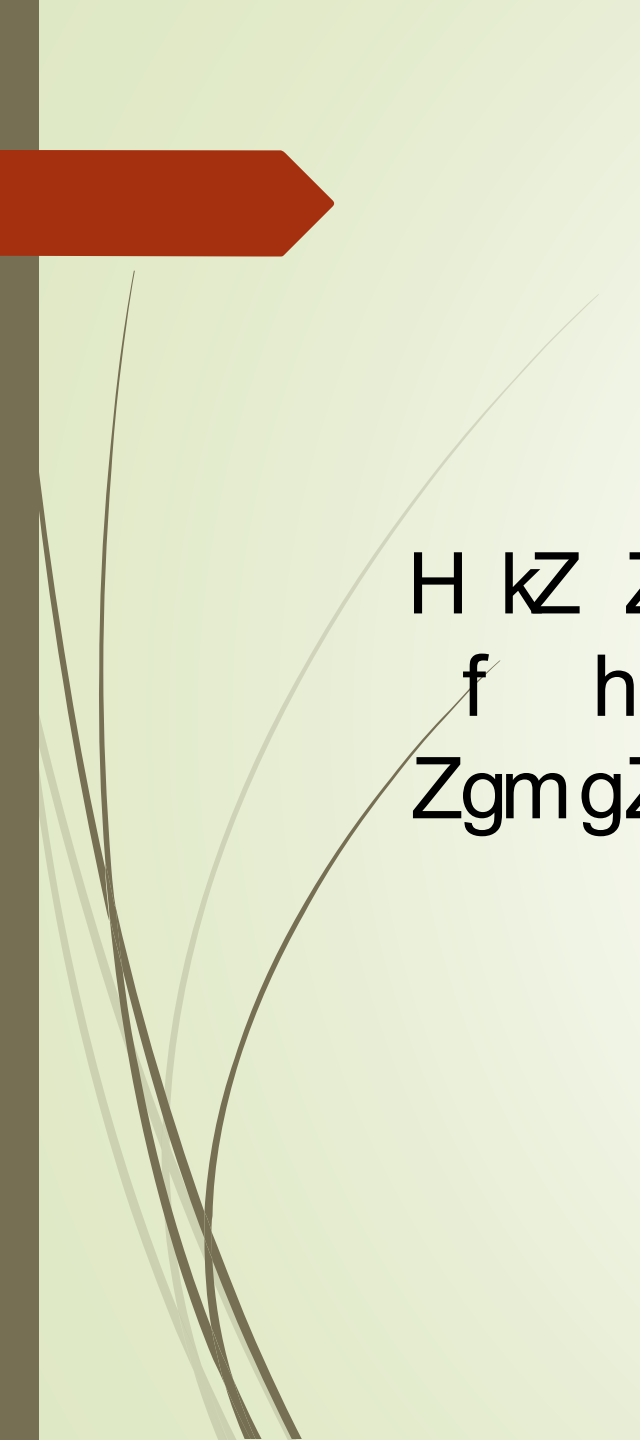
: K l h e h : - 00 Q B Z H K Z g s Z h F Z k e Z
B m k g Z b n g Z e B H % Z h n Z Z f 2 g h o f k h
21 % l n Z e h l i Z k l f Z h l l f i g a h
i Z k Z j n b Z f g h l k Z Z k b l n Z h l f g Z o b l i Z k Z
b l g Z o ` Z h > e ` Z k Z g m j n h k Z Z k h k g Z
b g h k f Z l h g b o b i Z k Z Z g Z o ` Z h i k o g h
h e l



HI i kg b Zb i Z k l i khkf Zg b gb hl
i hk ll Zk l h e h3



m h : ehl l khkf Zg : eZg



H kZ Zk o l k Zi Zs m nZkZehl h c rhl
f hg b l ghkf Zb i khi Z`Z h%hf Z
ZgmgZZ . f rhl Z bf Z h gZ e h f Zk3



Linhas de costa: A 20 milhas náuticas (MN) se o terreno subir para 60 metros, e a 7 MN se o terreno subir para 6 metros.

Navios: Um navio de 5.000 toneladas brutas deve ser detectado a 7 MN, independentemente da sua orientação.

Pequenas embarcações: Uma embarcação de 10 metros de comprimento deve ser detectada a 3 MN.

Alcance mínimo: Os objetos acima devem ser detectados a partir de uma distância mínima de 50 metros até 1 MN, sem alterar as configurações de controle, exceto a escala de alcance.

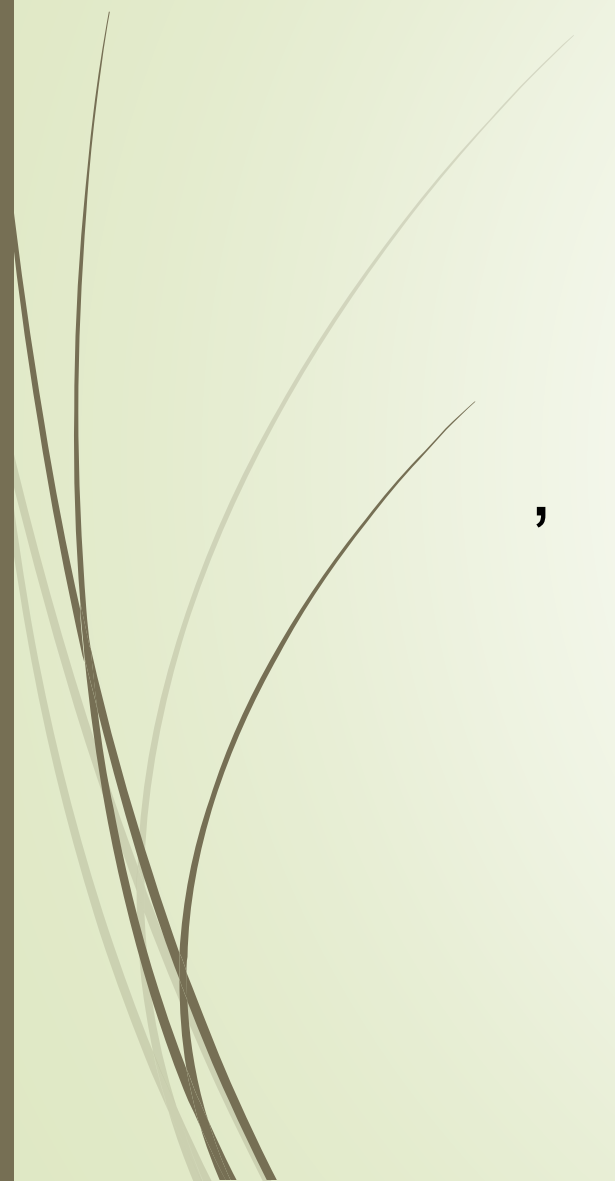


+ b k f g Z h K l h e n h B Z` f

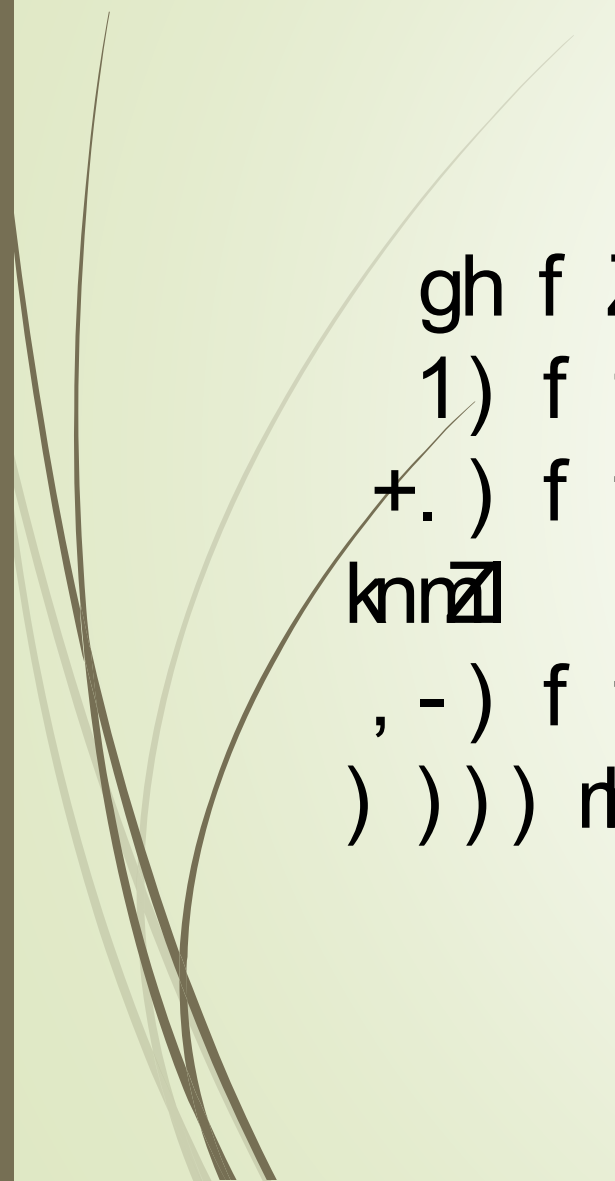


3H kZ Zk o l k Zi Zs
qb k% f l ZeZ + F G hn f ghl % hb i j n ghl
Ze hl l f bZk l l mZ hl gZ f l f Z Zsb nm k h
l i ZkZ hl i hkg h f Zb .) f rhl

o l k Zi Zs
qb k hb i j n ghl Ze hl l f bZk l gZ f l f Z
bmg bZ grk .)) Z l ZeZ % hn + F G
l i ZkZ hl i hkg h f Zb +% ` kZnl



, ObnZesZ h >I ZeZ bi eZr



H b1f rñ nñh ZmēZ o l k

gh f Zgb h3

1) f f i ZkZ gZob1 .)) Z /)) rhg ēZ Z knmZ

+.) f f i ZkZ gZob1 /)) Z)))) rhg ēZ Z

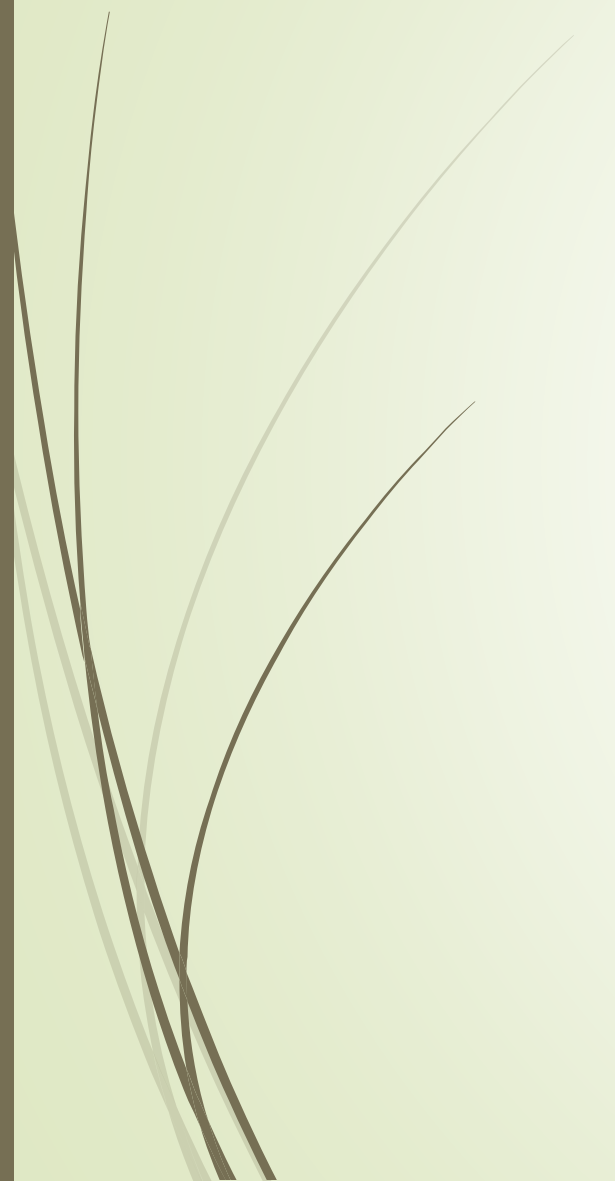
knmZ

, -) f f hn +.) f f l ahno k hb i ZkZ gZob1

)))) rhg ēZ Z hn f Zb



H j n b Z f g r h o l k Z i Z s
h i k Z k f f h o b f g r h k e Z n o h o k Z b h
o i k f b k Z l n Z b e s Z h
f Z s b f n m i h k h f i Z l h ` b h l l h e Z % h f
k h f q b f h) % ` k Z n l



- ng ~~hngZ~~ Z I Hi kZ ~~hngZ~~

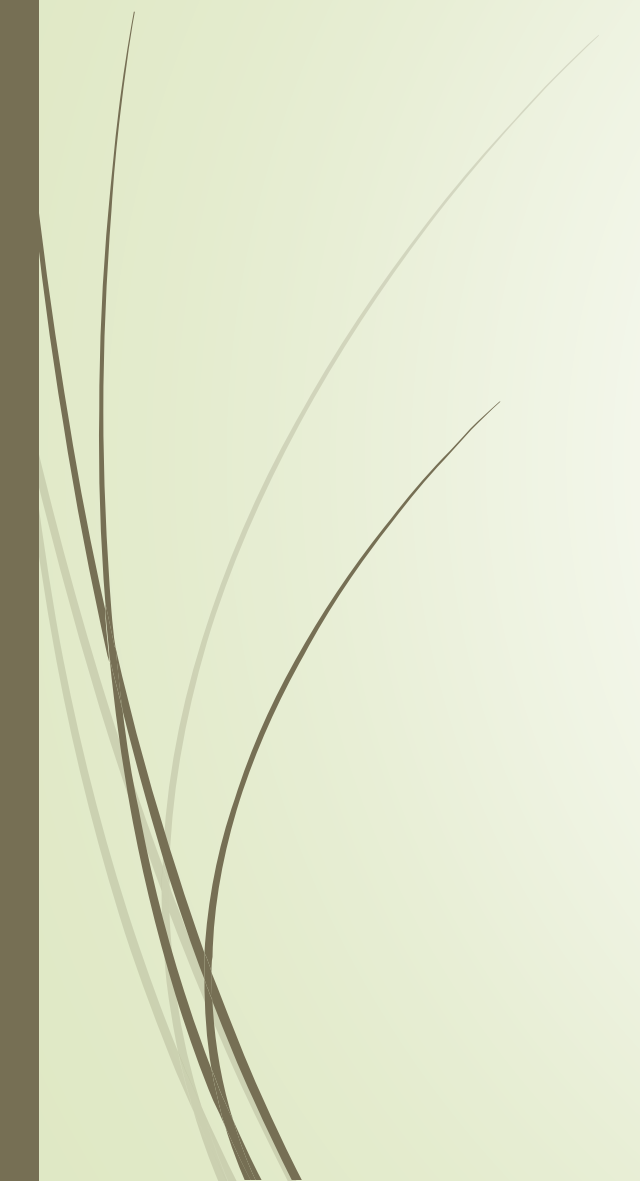


Varredura: Deve ser contínua e automática em 360 graus, com taxa não inferior a 12 rotações por minuto.

Anti-clutter (Filtros): Deve possuir meios adequados para suprimir ecos indesejados de chuva, precipitação e mar (sea clutter).

Verificação de Performance: O radar deve ter meios (como o Performance Monitor) para verificar se o equipamento está operando com desempenho máximo, sem a necessidade de alvos reais.

Estabilidade de Carga: O radar deve funcionar satisfatoriamente com o navio adernando até ± 10 graus.



. Bgl mZē h : gmgZ

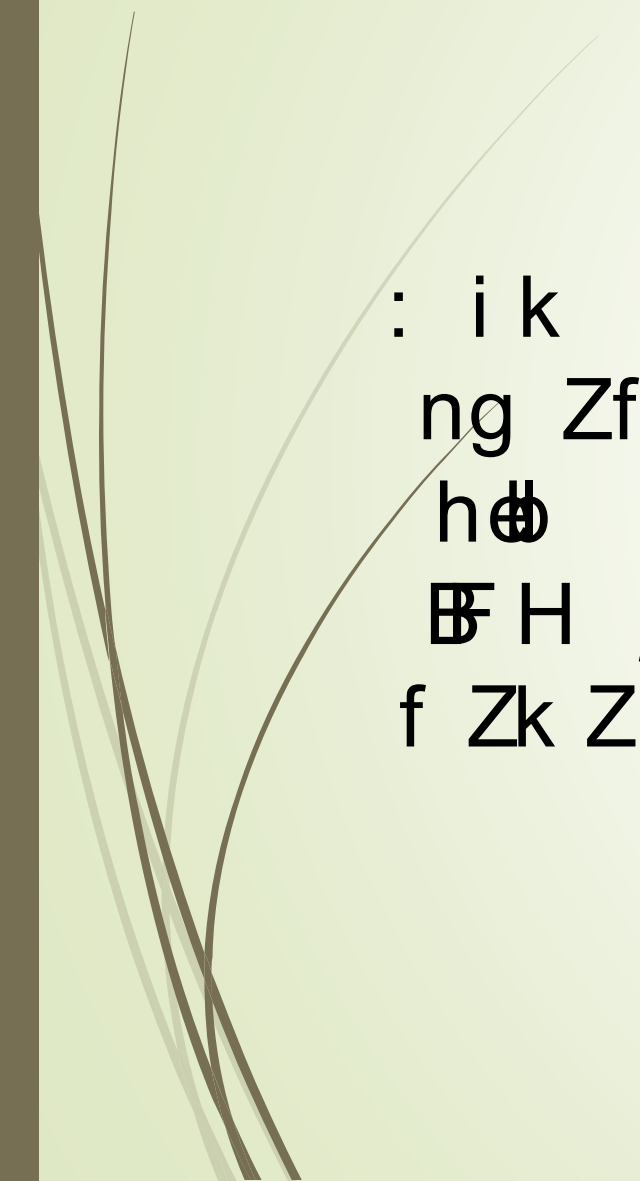


: Zgm gZ o l k b l n e Z Z
h k f Z Z g h h f i k h f m k l n Z b b Z g b Z %
i k k g b Z e f g m f i h l b h e o Z Z i Z k Z
f q b Z o b b b e Z % b g b b s Z g h l m k l ` h l
o f l k o b Z h l %
i k g b Z e f g m g h Z k h ++ % i Z k Z Z Z e Z h Z
i k h Z

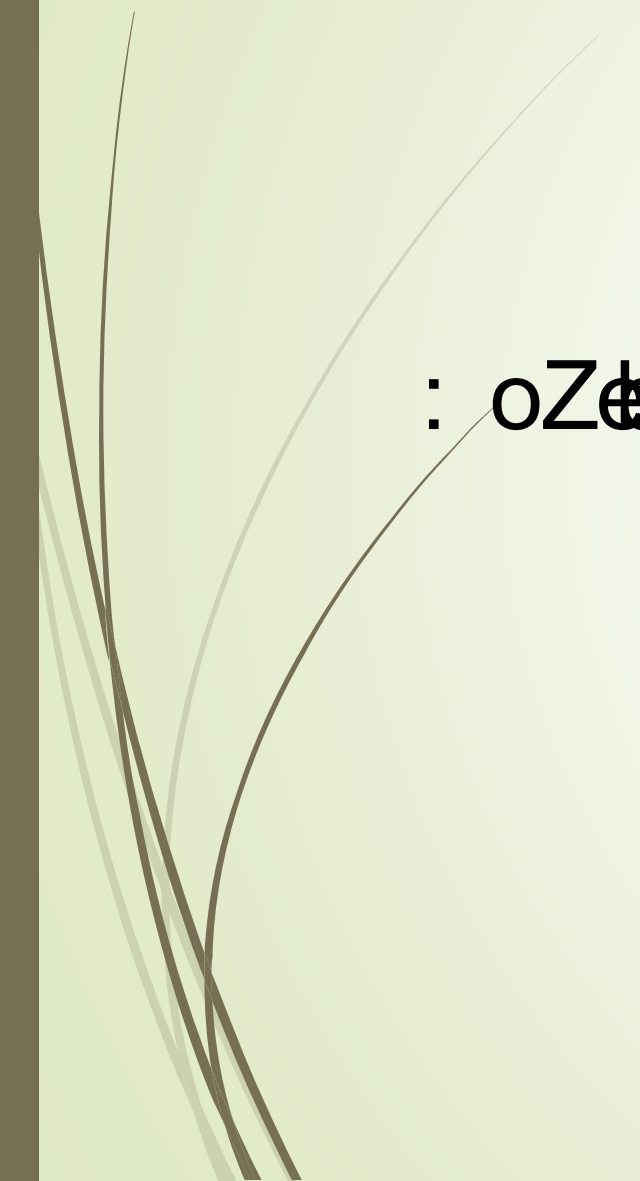
: K l h e n h : - 00 Q B h b n g Z f g n z e i Z k Z
i Z k h g b s Z k h l k Z Z k l Z g Z e h b h l i k f b Z
` k Z h b b z e % l m z e g h h l k j n b b h l
m z g b h l j n % h l m k k f g m % o h e n z f h f
h l k Z Z k l : K l : Z K l h e n h F L 2 + 02



: oZkZik b h li bbZ ZgZ f bZ
f Zk Z h bmg bZ

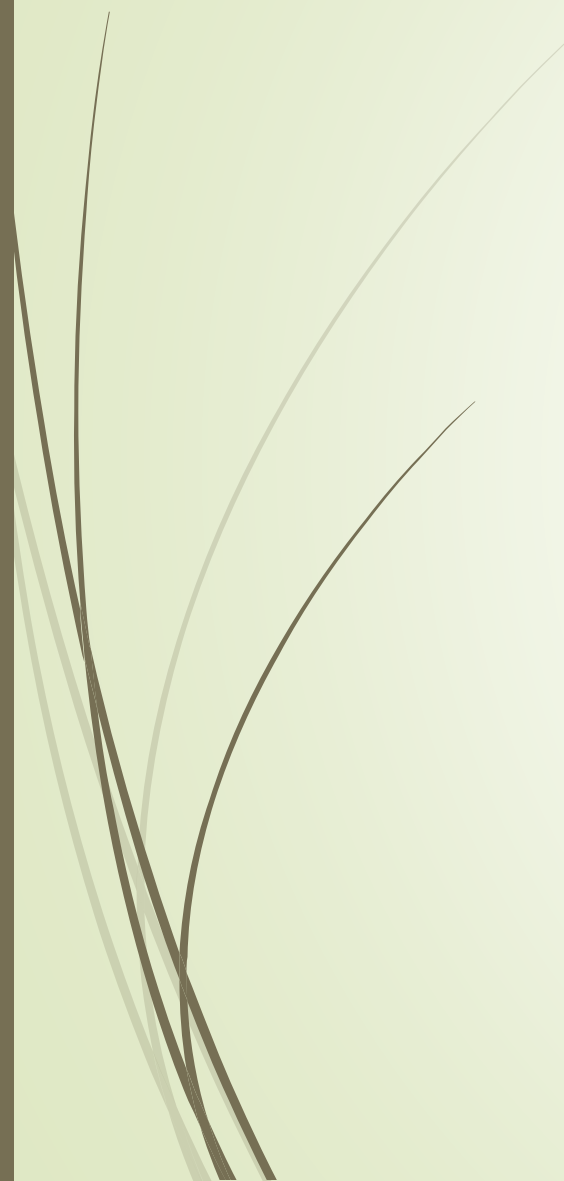


: i k b h Z f b l f nf kZ Zkf ZkZ h Z
ng Zf grZei ZkZ Z gZo ` Z hl ` nkZ obZ h
h b l % g h k ` b Zi hk ghkf Z bmgkgZ bmgZb
F H j n b g f e f bnl li Zb hl i ZkZ Z
f Zk Z h k h bmg bZ



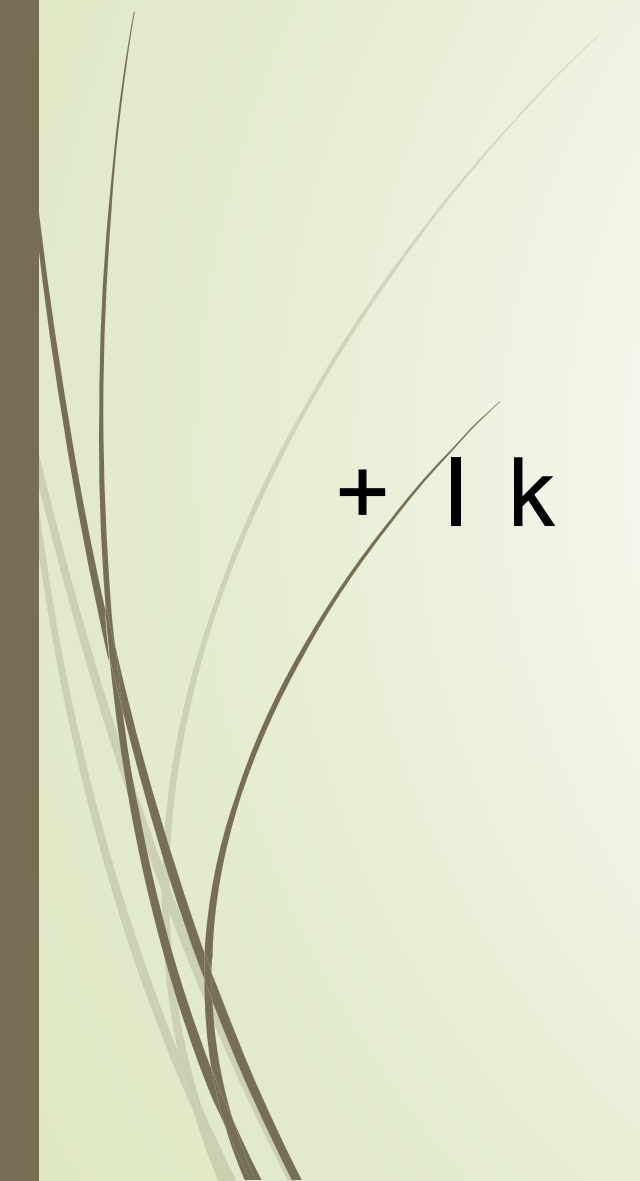
: oZēZ h mēZ Z Z Z Z Z ghl i Z k l
l f i gah3

: i k b h Z f b l f nf kZ Zk
f Zk ~~h~~ h Z ng Zf gmZei ZkZ Z gZo ` Z h
l ` nkZ obZ h h ~~h~~ l % g h
k ` b Zi hkghkf Z bmgkZ bmgZb B H
jn b g f ~~e~~ bnl li ~~h~~ hl i ZkZ Z
f Zk Z h k h bmg bZ



l k b h bmg bZ KZg` : nkZ r

H kZ Zk o l k Zi Zs f kZ bmg bZ
Zn nf Zeh hf nf Zik b h ,) f rhl hn Z
l Ze ZeZg f nl h% Ze g h h f ZbkoZek
>f nf Z l Ze , f baZ g nrbZ
Zi khq ... / f rhl % jnbZe Z kZ .. f rhl
l hkmZgrh%Zik b h l kZ .. f rhl g l m Zh
k ZeZ Z ZkZoZ ZgZb bmg bZ kZg`
kg`l %hf f Zbki k b h% eZFZkZ bmg bZ
OZko e OZko e KZg` FZkd OKF



+ l k b h F Z k Z h ; Z k g : n k Z r

3 i k b h gZf b h Zf Zk Z h
Zsf nm nf Zeh o l kg kZ
3>f hkZZ li bbZ hl cZ kg kZ %
Zrk l hf h Zek nkZ h q ZZgmZ Z l nZ esZ h
ZZ`neZ`hl HbZih f g e g bZ% g h j n f
hg b l k Zb%Zik b hih oZkZ%f hkZZghkf Z
qZik b h ZeZ
3K esZ Z ZrkZoZ ZEgaZ F Zk Z h
>erkgbZ >e rhgb ; Zkg` Ekg >; E



, Zhk l j n : n̄f Zl k b h

3 i g Z eZ` nkZ
h b ahkshgnZe Z ZgmngZ4 b l f Zb
l n bhl h k f f eahki k b h
3 i g Z nkZ h
h i ne h i ne e g` na 4i nehl nkhl f eahkZf
Z b ng h grk Zehl i k h b hl
3> khl gZ ob nZeZ h
nk hk l f igbhl Zgrbhl

3 anoZ kZbg emmk f ZkZ' bZ h
l Z emmk ih f ZmgnZkhn h neZk hl %
qb bg h Znl ml f ZgnZb `Zgah l ni k l l h %
jn ih k nskZik b hl f ZeZnl nZ hl
3F hobf grhl
ZkZ' f i ma ZeZg h kne l ni k l Z (
) ih f Z nZkh l f i gah



- hf h O kbb ZkZl k b h Ze kZ h

3 hf i ZkZkZ f Zk Z h kZ Zk
nf h c m qh hga bh hf h nf Z HZ hn
Zkhe hf Z f Zk Z h ob nZehn hf Z Zkz
g nr b Z

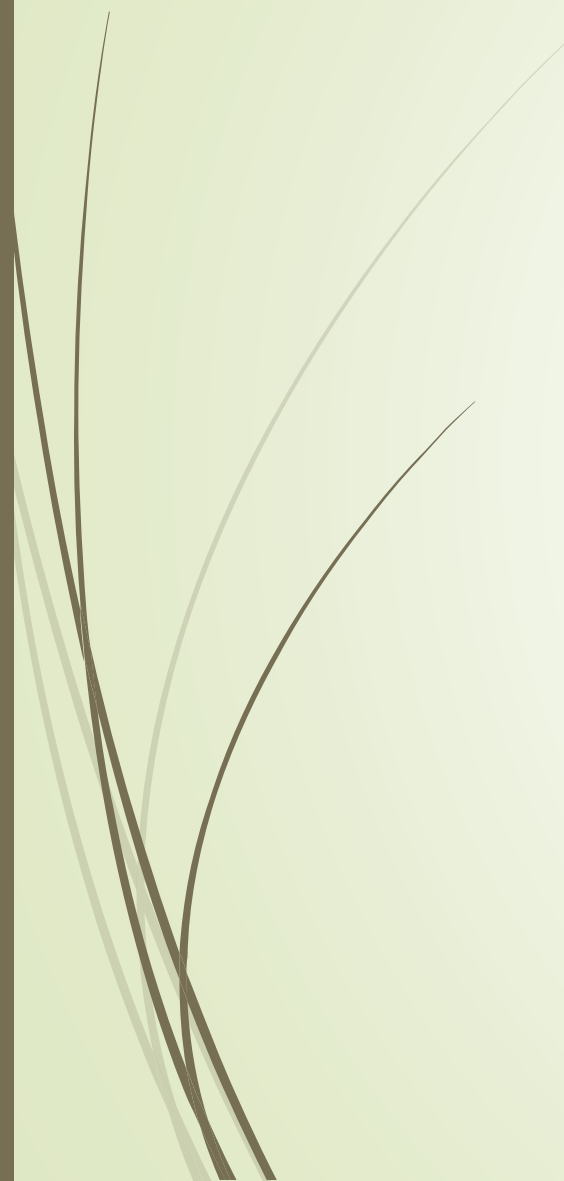
3
O kb b Zkl Z egaZ i khZ h kZ Zk h b hf Z
i khZo k Z kZ Z f Zk Z h

3>j nb Zf grhl o f l k
o kb b Z hl Z hk h hf Z ghkf Z Z Znrhkb Z
f ZkZ Z e Ze q3F ZkgaZ h ; kZ b Ghkf Zf



>qbò Æg b̄ i ZkZ b̄ kf bgZ h Z f Zk Z h
Z b̄ mg b̄

: l qò Zg bZ nZ gb Z i ZkZ Z b kf bgZ h
Zi Z b Z b k g bZkZehl i kHbf hl
f Zk Z h Zsb nm bmg bZ f kZ Zk l
f ZkZhl l h bgb Z bmgkgZ bmgZe gm i eZ
HK ZglsZ h F ZkZ Z bmgkgZ bmgZe B H %
i kg b Ze gm gZ K l he l : - 00 QB
FL 2+ 02



Hi k j n b b h l i k g b Z b l h 3



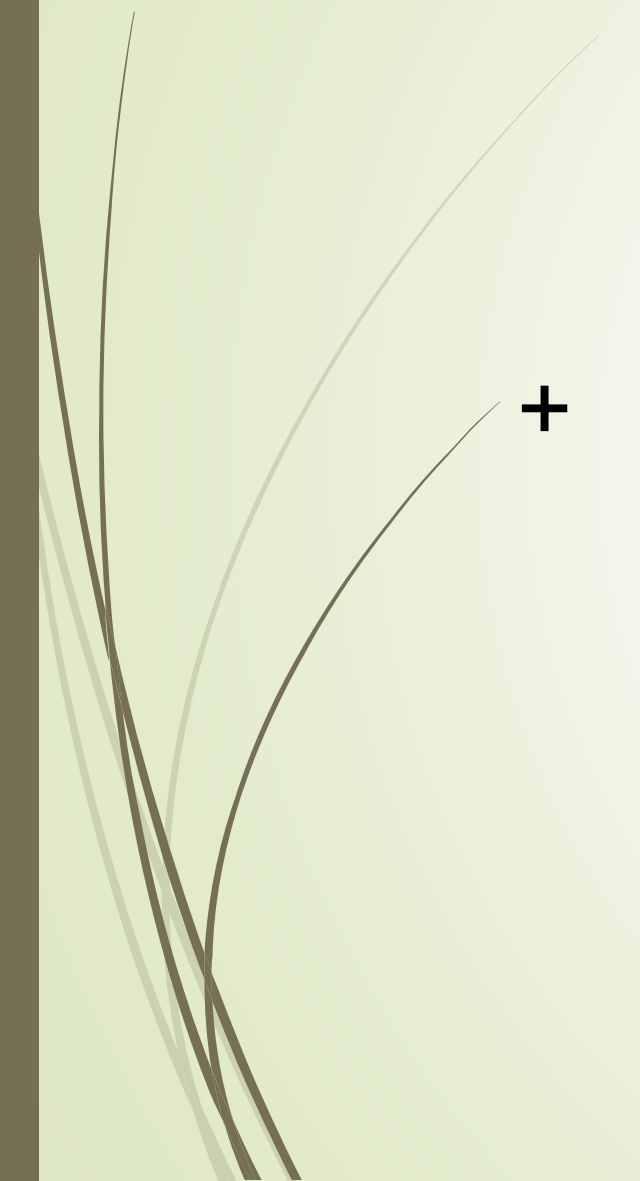
b kf gZ h

b mg bZ KZg`

b kf gZbmg

A capacidade de distinguir dois pequenos alvos situados na mesma marcação (no mesmo rumo), porém a distâncias diferentes.

3H kZ Zk o l k Zi Zs f hl rZk%hf h
bg bZ l l i ZkZ Z %hb i j n ghl Zehl l bnZ hl gZ
f l f Z f Zk Z h% i ZkZ hl i hkgh f qb h -) f rhl f
bm g bZ% f l ZeZ % f baZ g nr bZ GF hn f ghl %Z
nf Z bm g bZ grk .))) Z l ZeZ f nl h
3 mkf bgZ Zi kg b Ze gm i eZ
nkZ h h ineh nkZgl f bl h inehl f Zb nkhl i kf bnf
f ehkk l hen h

$+$
 $\log Z_h(F, Z_k, Z_h; Z_k)$
 $\log Z_h(K, h)$

A capacidade de distinguir dois pequenos alvos situados à mesma distância, mas em marcações (azimutes) diferentes.

3H j n b Z f g r h o l k Z i Z s q b k % h f h
b g b Z l l i Z k Z Z % h b i j n g h l Z e h l l b n Z h l
f l f Z b m g b Z % g r h .)) Z l Z e Z % h n +
f b a Z % l i Z k Z h l i h k g h f Z b j n + % ` k Z n l f
Z s b f n m

3 m k f b g Z h i e Z e Z k n k Z
a h k s h g n Z e h b q Z Z g m g Z b q l f Z b l r k b h l h
f e a h k k l h e h h Z g ` n e Z k



, l k b h gZ F Zk Z h bmg bZ

Além da discriminação, o radar deve garantir precisão nas medições:

3HI ZgZb bhl Z f Zk ZoZk o e
OKF o f i kf bbf bZ bmg bZ hf nf kkg h
l ni bbfZ,) f rhl hn Z l ZeZ bmg bZ f
nl h%b j n hkf Zbk

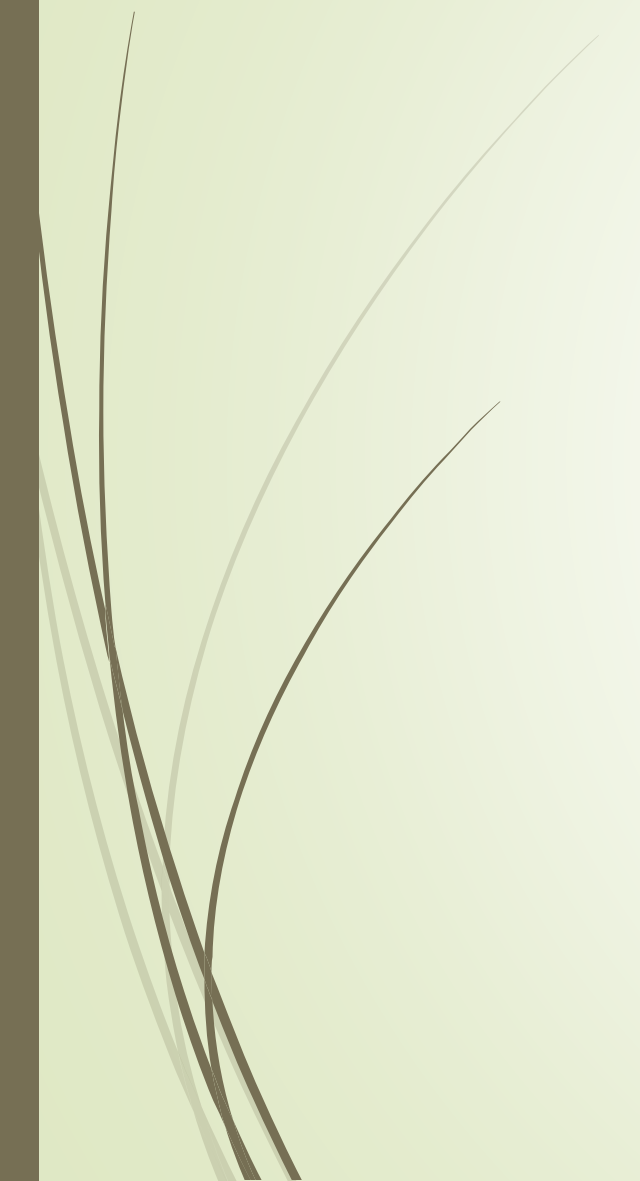
3 >e rhgb ; Zkg` Ebg >; E
o i kf bbf bZ f Zk Z h nf Zeh hf nf Z
i k b h `kZn hn f eahk



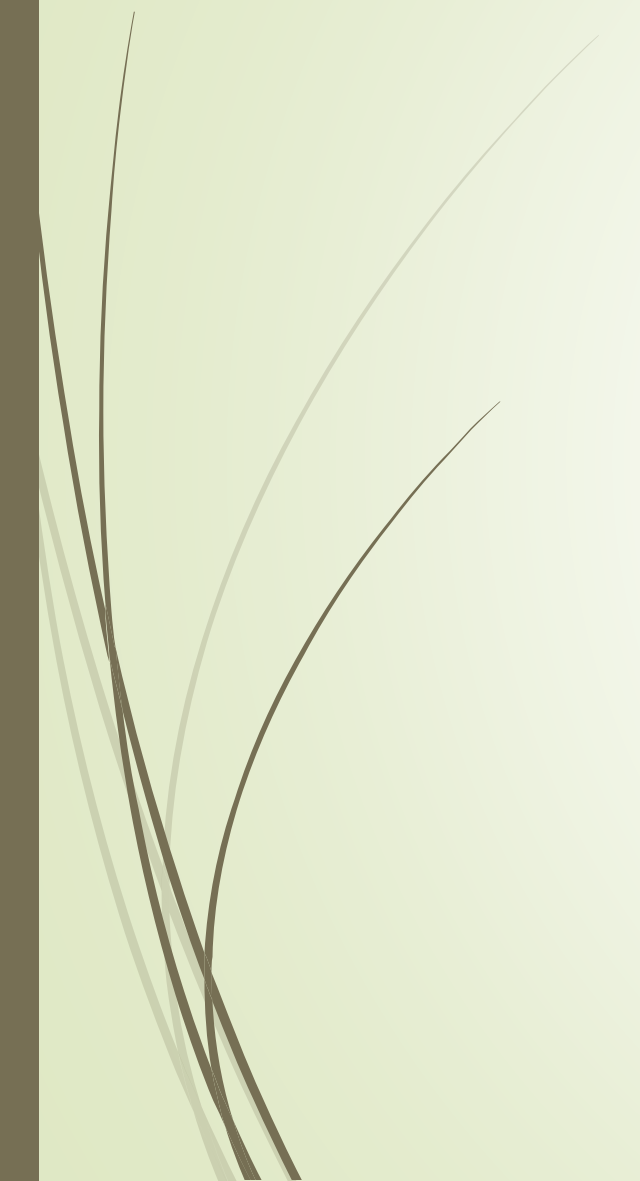
Horizontalidade está modelada por uma rede de 40 x 50 metros



>qb h nf i kf grh
l m ghkf Z i ZkZ Zl `nkZg Z ZgZo `Z h
lg hl i Zkif rhl
m gbhl qZrhl Z bf Z f g lngZ hl

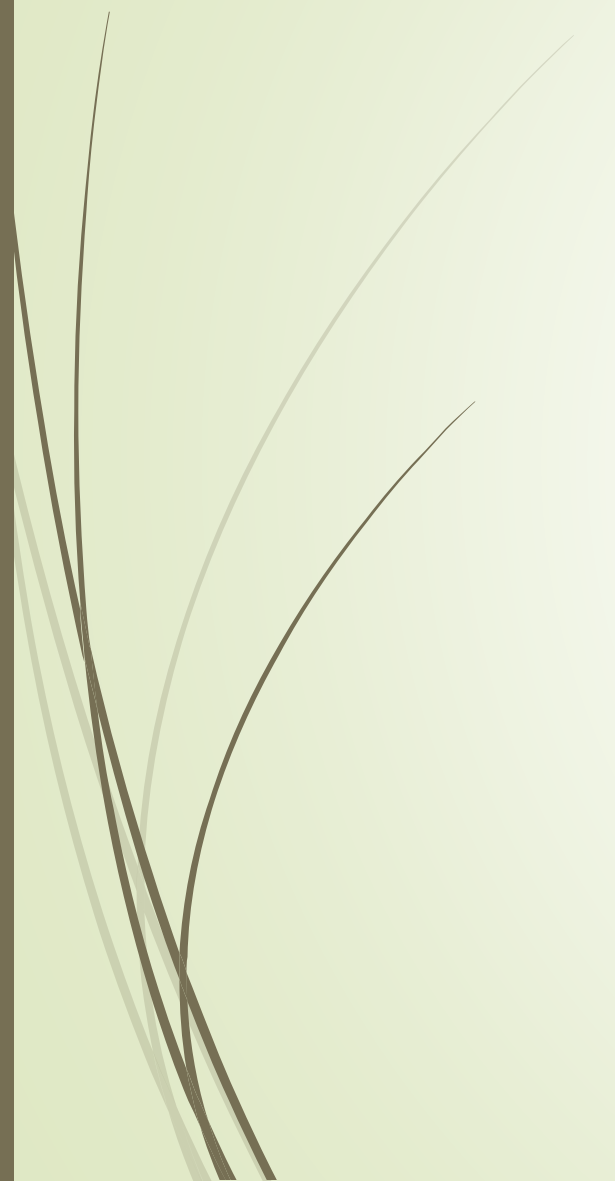


H L B M $\triangleright$ F : : K I :



: l ZkZ mkZ h l bmf ZkZ Zk
f ZkZ h: KI:

H I b m f Z k Z Z k f Z k h h : K I : : n r h f Z r b K Z Z k
l e m g : b l Z n f Z m g h e b Z h f i n n Z h k s Z Z
Z o Z g Z Z Z h i e Z Z h k Z Z k h g o g b g Z e % k h c n Z Z
i Z k Z Z n f g n Z k Z l ` n k Z g Z Z g Z o ` Z h %
Z n r h f Z n s Z g h h k Z r k Z f g r h Z e h l Z Z o Z e Z h
k b h h e b h > e e f b g Z Z g I I b Z
i e m Z ` f f Z g n Z e % h k g g h b g h k f Z I f m f i h
k Z e l h k h n r k h l g Z o b l h I m n e l



: l i k g b Z b Z k Z m k l h b Z h
l b m f Z: K l: b g e n f 3

3H : KI :

i h Z j n k k Z r k Z k f e i e l Z e h l ` k Z e f g m

+) h n f Z b l b n e z g Z f g m % Z e n e z g h

Z n r h f Z r b Z f g m l n l f h o b f g r h l

3H l b m f Z Z e n e z

h g r h g n Z f g m h i h g r h Z i k h q b f Z h f Z b

i k h q b f Z l : e l l m h g r h : i i k h Z a h

m f i h i Z k Z l l i h g r h M l : M b m l : %

Z e k n z g h h g Z o ` Z h k l h k k b h l h e b h



>qb o mkl `k bhl lh k hl Zehl %g bZg h h
knf h Zo e bZ m o mkl hnh f hof gh
f k e h Zhl nik h k gZob k e h o o mkl
3l hll nbng l

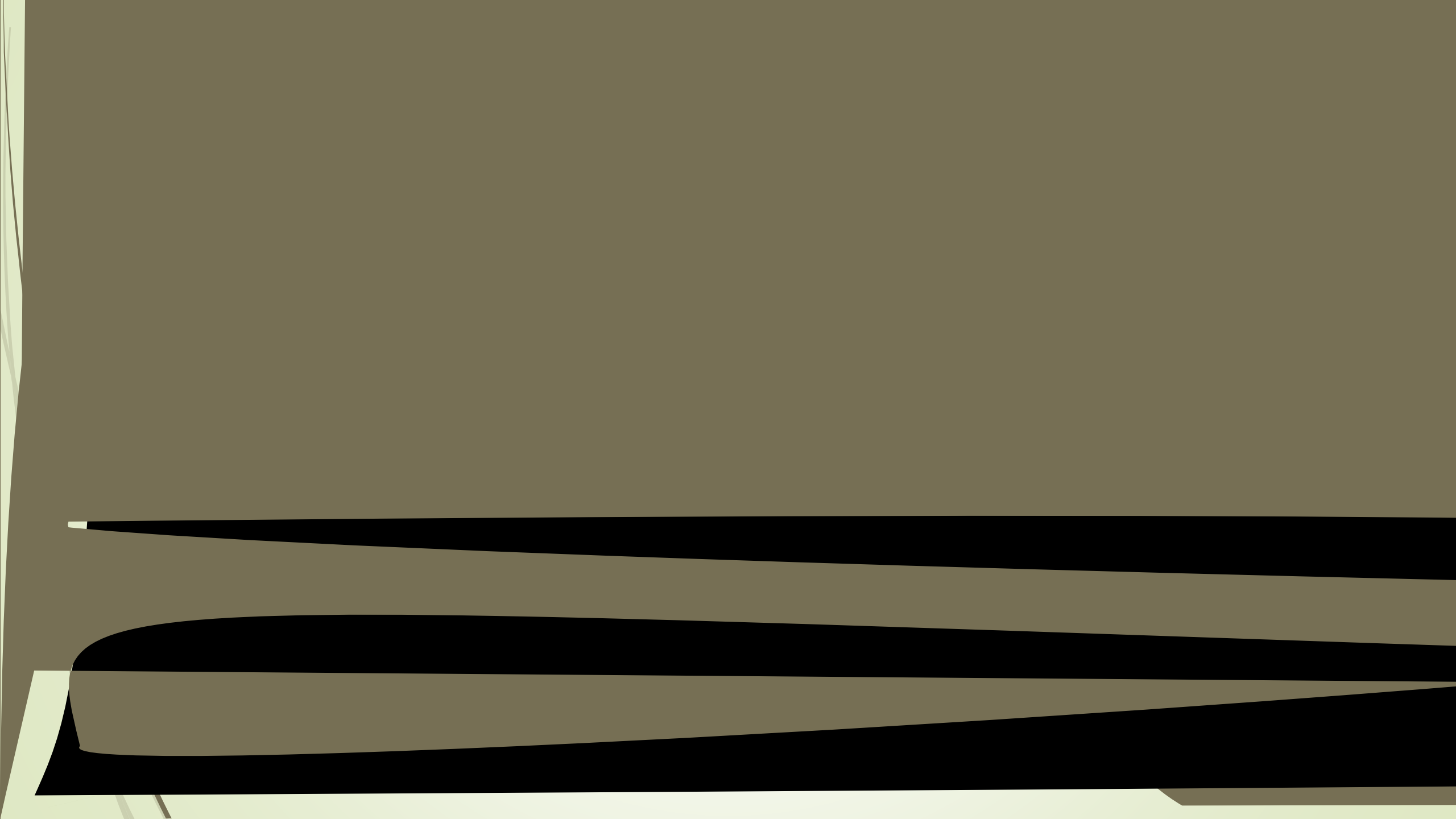
`nZk shg l shgZ `nZk Z jn %j nZg h
hg bñkZ Z % m nZf kZ m bZf Znrhf Zrb Zf gm
jnZj n kghoh Zeh jn grk gZ k Z lgb Z



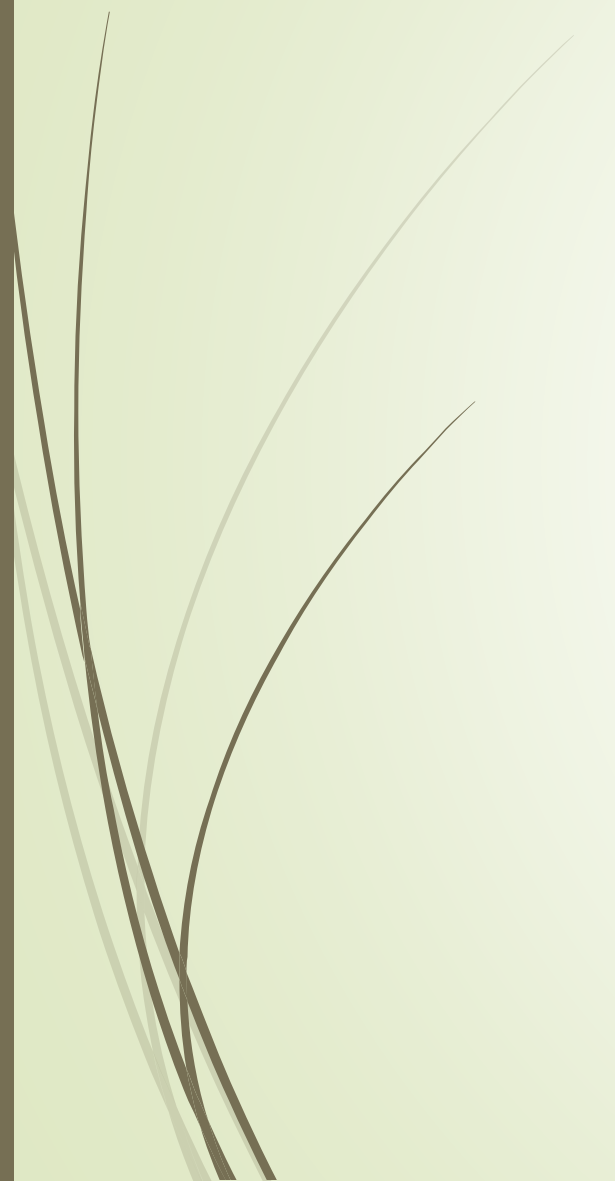
l kf bn j n h
hi kZ hkl bf ne nf Z f Zgh kZ l obn f n Zg Z
knf h hn o e b Z i ZkZ ZoZeZkl ZZ h obZk Z
he h Zgml k Zes eZ Zh
Bgm` kZ Z hl i hl b h%anf h
o e b Z obZ l L khl H b i ZkZ hkg k
bg hkf Z l i k b Z % h g h nZf Zf bg hki hkZk
bg hkf Z l h: B : nmhf Zrb B grbb Zrbg Lrlmf



>f bn ZeZkf I I hghkhl
obnZb jnZg h nf Zeh nekZi Zl Zhl ef bnl
I: (M I: i k gbhl %jnZg h nf Zeh Zi k bh hn
f I bnZ I Zi khqbf Z hi kòhl Z
>qb h kZ rh Zgmkbk hl
Zehl kZ rh Z hl % kf bng h obnZesZkZrhZc mkbZ
k gm h gZobh Zeh



HI i Z k l ng bngZf gm h kZ Zkf ZkZf h: KI:
: nmhf Zrb KZ Zkl emg` : bl : nqZfhl l emZ` f
: nmhf rbZ KZ Zkl h bghl i eZ HK` ZglsZ h
F ZkZf Z BmkgZ bngZe B H % kg b Ze gm ZrkZoZl Z
K l h e h: 1+, 2 k l h e l FL
Zgmkl (i hl mkl % b Zg h Zl ` nkZg Z Z
gZo ` Z h Zik o g h h e l gh f Zk



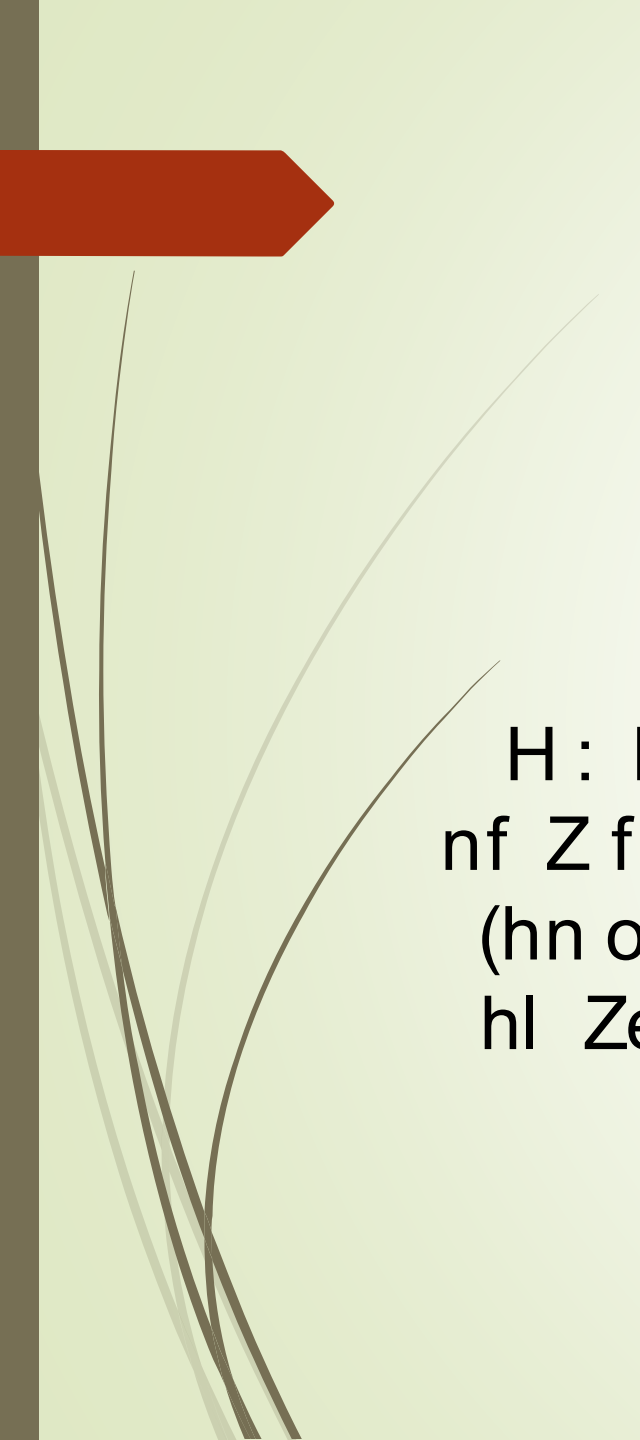
HI i k g b Z b i Z k l ng b g Z b
mkf b g Z hl i e Z B H b g e n f 3

H: KI: o l k Zi Zs Z j nkk
Znrhf Zrb Zf gm i e f ghl +) Zehl hn f ZgnZe gm)
Zehl kZ rk el hgnZf gm
H l bmf Z o f Zgmkh kZ rk Zf grh
nf Zeh f .) oZkk nkZ hgl nmZ h kZ Zk
o Zi k l grZkZmg Zg bZ
f hobf grh h Zeh f ZnZ f bgnrh h f hobf grh
i k obrh o rhk f ZnZ, f bgnrhl

3H: KI: o hi kZk f f hobf grh k eZnoh %
hi bhgZef gm% f f hobf grh o k Z bh
o qbko rhkl f hobf grh o k Z bh hn
k eZnoh jn f hlrf eZkZf gm ZrkZc mHkZ i k obmZ h Zeh
o hkg kbg mZgrnZg Zf gm%Z
i bh h hi kZ hk%Z hl hf h3f Zk Z h%bmgbZ%I:
i hgrh Zi khqbf Z hf Zb i khqbf Z%M I: mfihiZkZ
I: %nk h o ebZ h Zeh
o qbkgf hf h%jnZrh i hl b I
i ZIZ ZI bnZef gm li Z Z ZI gh mfihiZkZjnZejn kZeh
kZrkZ h

3

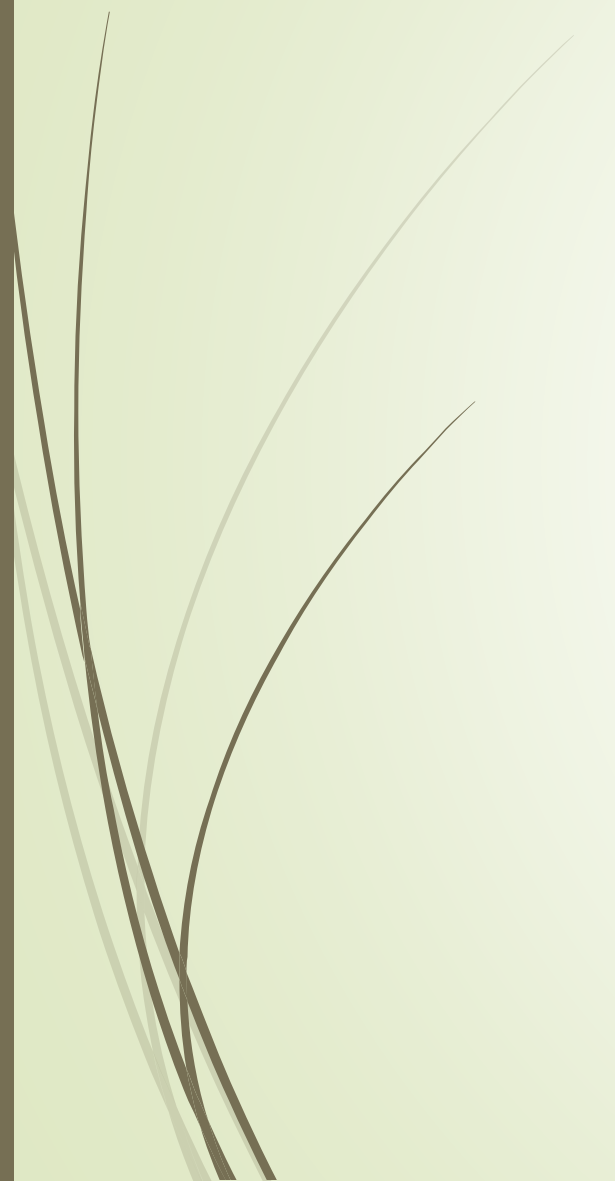
: ehl j n Zng` f nf I: (M I: lgb h i e
hi kZ hk ShgZ I kò h
: ehl j n grkZf f nf Z shgZ ` nZk Z
lgb Z
I k Z Ze h kZ rk Z h h l b mf Z o lgb ZkZ
ef Zi h l b h hga b Z



H: KI: o i k f ~~ok~~ Z l f n ~~z~~ h hl ~~ohl~~
nf Z f Zgh kZ h i k H k ~~h~~ g Z o ~~h~~ f n Zg Z nk h
(hn o ~~e~~ b Z l f ~~g~~ m k ~~h~~ f i kh kZ ~~rk~~ Zf grh k Ze
hl Z ~~ohl~~

: k Z mZ h l l B l eZg l h l mng
B bZrhk o mknf bnf rh i e f ghl , -) f f
i ZkZ gZohl Z bf Z)))) M
o l k Zi Zs hi kZk hf
l nZ esZ h f ghkm Ghma ni hn knf h A Z ni
: l Z oe Z l : Kl: o f l nZk
b i h gZ h b f l ZeZ ZeZg + hn / f eaZ %
, hn - f eaZ

H: KI: o nmsZk Z hl grkZ Z `h hf i Z l h
jnbZf grh f b h o e b Z Eh` i ZkZ
`ZkZgrkZik b h Z l nZ bZ h hl o rhkl
o k Z hl (k eZhl
o i kf bZ grkZ Z f ZgnZe o e b Z) Z,)
gH Z h h e` Znrhf rbh Ze



: l hkf Z Zj nb b h Zehl

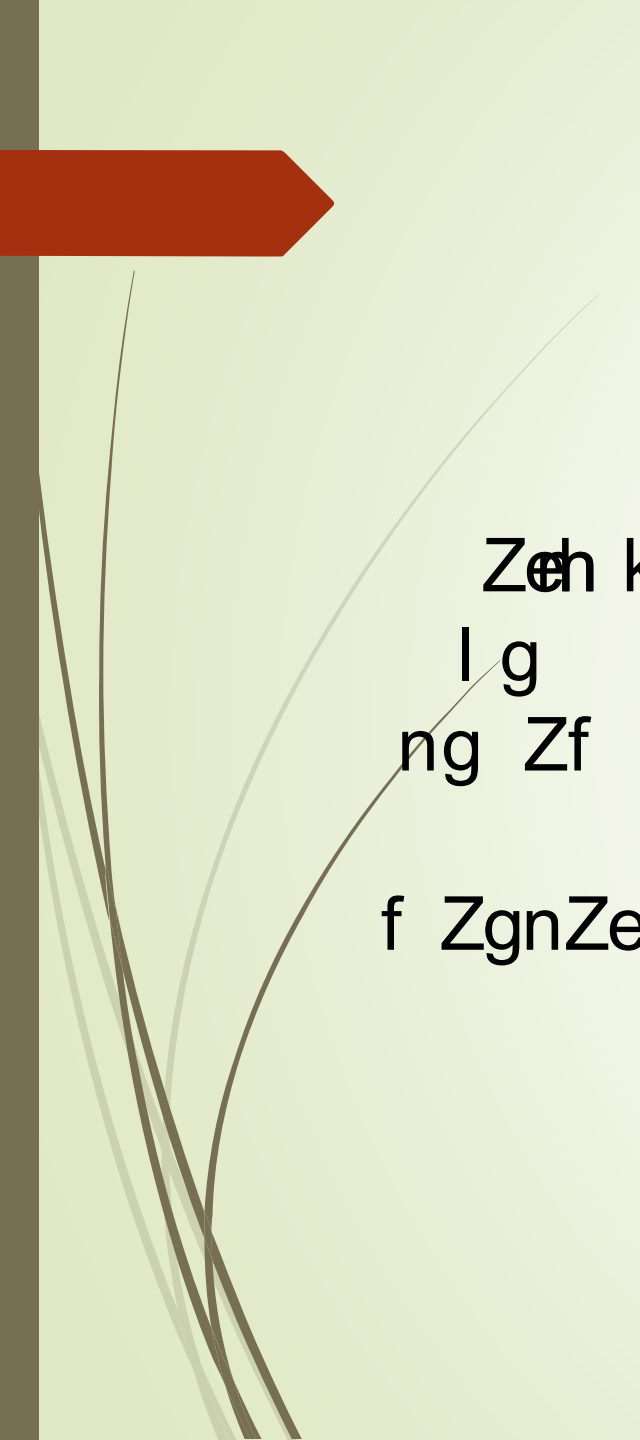


: l hkf Z Zj nb b h Zehl gh: Kl: ob f l
f f ZgnZe Znrhf r Z% g h h f Zrh h Zj nb b h
f ZgnZeh k Znrhf f rh hl hl l bmf Z.

A aquisição manual é realizada diretamente pelo operador (oficial de náutica) no passadiço.

H hi kZ hknmbZnf chr l r b d%kZ d Ze
hn meZ l gl eZh mj n i ZkZ i hl b ngZknf nk hkl h k h
h nf Ze h li Zh f Zk Z h%hbZ gZmeZ h
kZ Zk

: h i k l l ngZkh hmh : jnk : jnk hn eZk
gh Ze h% hf i nnZ hk h: KI: bbbZ h kZ rk Zf gh
Zjn e i hgh li Zh



I kf bn Zh hi kZ hkl e bngZkZehl li Zhl
Zeh kb h hn bmk ll % obzg h h kZ rk Zf grh
lg ll kb emmk bmk kZg bZ f Zkhn anoZ
ng Zf gnZe f k Z rk `h gl h
H hi kZ hki h Zg eZkh kZ rk Zf grh
f ZgnZe jnZejn kZeh ZjnZejn kf hf grh

A aquisição automática utiliza algoritmos para rastrear alvos que entram em áreas pré-definidas pelo operador.

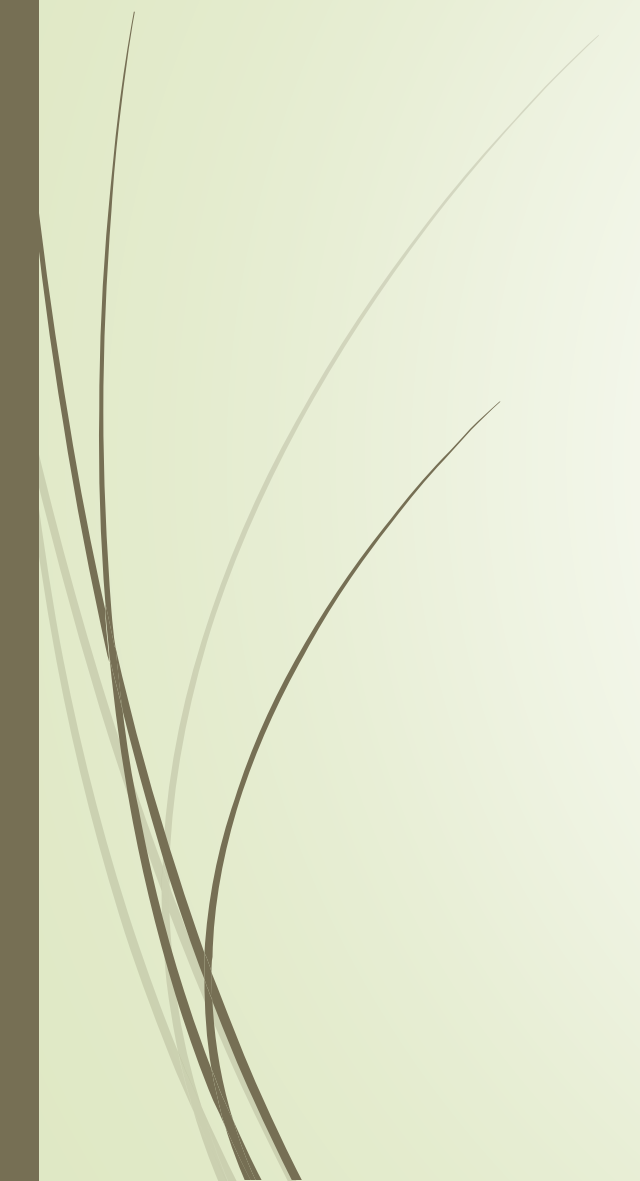
H hi kZ hk lg shgZ Zjnbb h
Znrhf rbZgZmeZ i hk q f i e%nf Zhk hk h
i kH kgZob hn nf l rhk li Zh
JnZg h nf Zeh h gmZg l l Z k Z
hg b nkZ Z%h: Kl: Znrhf ZrbZf gm Z jnk h Zeh
hf ZZi enZkl n o rhk f hof grh ZeneZk Z hl



I h ` kZkZeZkf I Ze hl f hg b I
hkm emmk k rhkgh f Zk anoZ % qbò b h Znl m bgh
hl hgrkhel ` Zgah I ni k l l h

Lbm f Z : KI : f h kghl i kf bnf
I ni kf kZ Zj nb b h Znrhf rbZ f kZ k Z % hf h
i kHqb h Zi hkhhl hn k Z hf f nbZ hbZ bZ

H: KI: o l k Zi Zs kZ rk Zk
Znrhf Zrb Zf gm i e f ghl +) Zehl l cZf Z jnb hl
f ZgnZehn Znrhf Zrb Zf gm
: i H Z Zjnb b h%h: KI: o
hkg kZmg Zg bZ f hof grh h Zeh f Zn
f bgnrh ZrkZc mHkZ i k obnZ f ZnZ, f bgnrh
H kZ rk Zf grh hgbo e i g Z
grkZ Z hkk nZ knf h Z`neZ` bh o e bZ
h f rk h i kH kh gZob



: | Zi Z b Z | ef bZ | h
| bmf ZkZ Zk: KI:

H: KI:

i h Z j n k k Z n k Z k Z n r h f Z r b Z f g m
f e i e l Z e h l ` k Z e f g m Z n Z +) h n Z e h l
l e b g Z h l f Z g n Z e f g m
> f b n Z o b h l o b n Z b
l h g h k h l i k o h h e b h M l : (l :
Z Z b h h e f b n h n Z e h l i k b h l

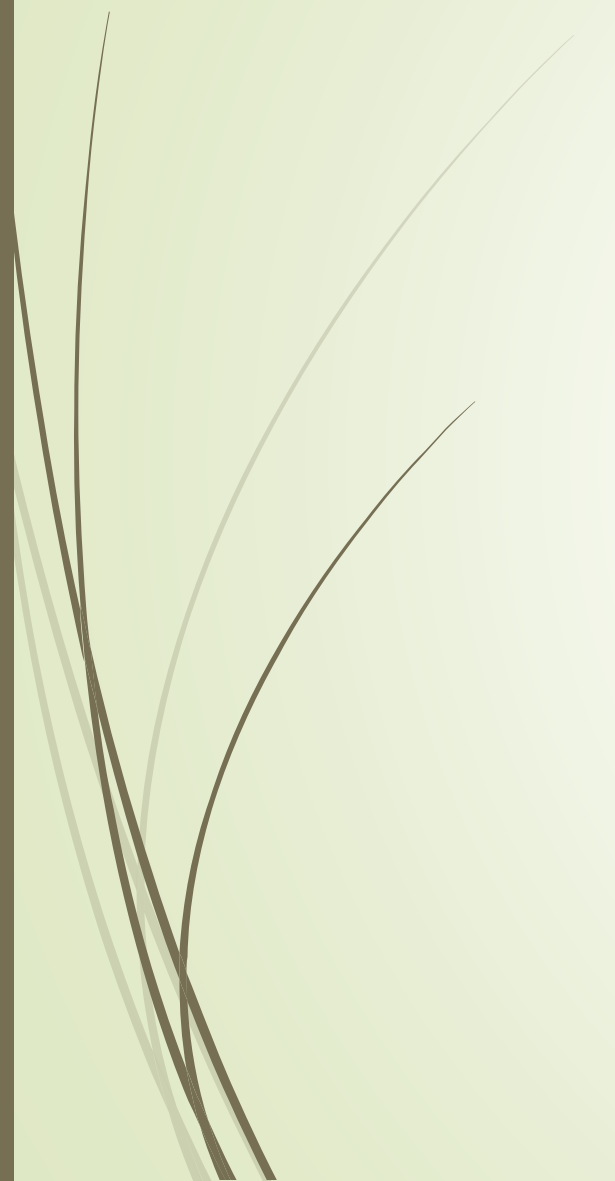


I kf bn Zh
hi kZ hkl bf neZkf Zgh kZ i kH kZ i ZkZ ZoZeZkh bh
f Zehl % f ZenkZkh knf h k Ze
Bgm` kZl Zh l L% rk hf i Zl
: B i ZkZ f Zbki k b h

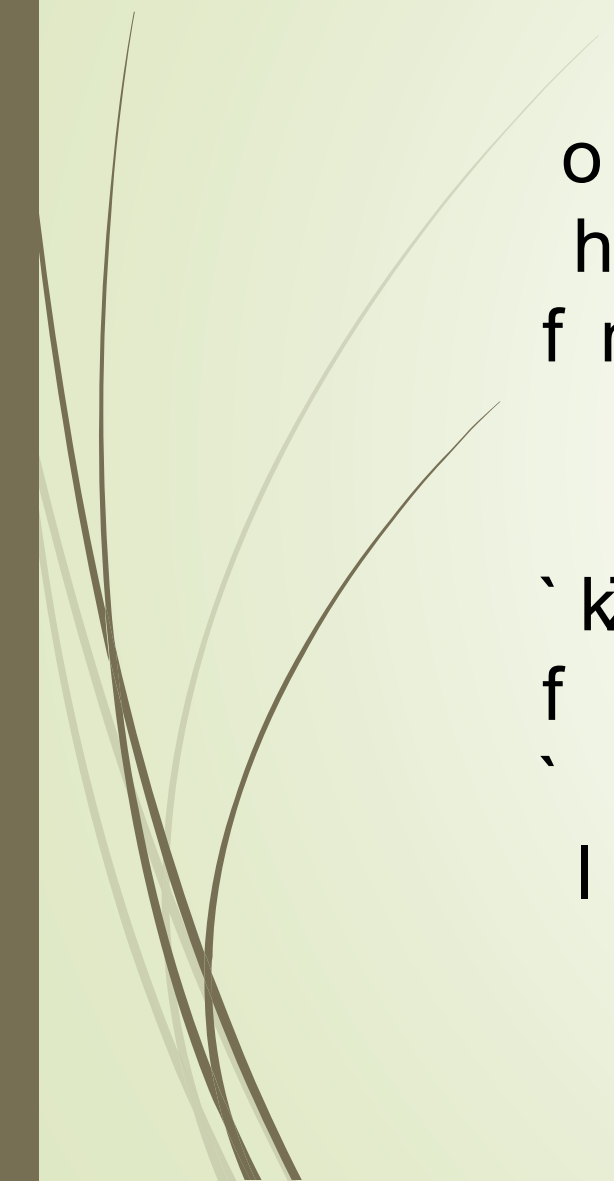
hkg hg hkf Z I f
mf i h k Z e l h k h Z e h % g e h g h 3

I: e l I m h g m h : i i k h Z a I h g m h : i k h q b f Z h
F Z b I k h q b f Z 3 b m g b Z f Z h Z I i k Z Z
M I: M f m e l I m h g m h : i i k h Z a M f i h i Z k Z h
I h g m h : i k h q b f Z h F Z b I k h q b f Z 3 M f i h k l n Z g m i Z k Z
Z h g ` k h I:

K n f h O e b Z h: e h 3 i k l g n z o r h k l
f h o b f g m o k Z k h h n k e z h o h



Ebf bZ I h L bmf Z: KI:



H: KI: ik bZ mfi h
o kZ oZkk nkZ Z ZgmZ iZkZ ZeneZk Z hl
hgbo b >f l mZ l ZeZ o e bZ hn
f n Zg Z nk h h Ze h % Z b hkf Z hih l k
Z Z Z eZ

: ehl
` kZg l i h f mkl n grh hhl bZg h
f bZjn Z f ZkZ h ZeZg Z k e g (i m a g %
` kZg h khl gh ene i h l b h o mk %
li bZ e gm Z nkZ bmg bZ



anoZ% ZkZ' bZ h hn k e qhl

gZ hl nZ l Z(kZbg emmk i h f h neZkZehl

i j n ghl hn Zs k hf j n h: KI: i k Zh

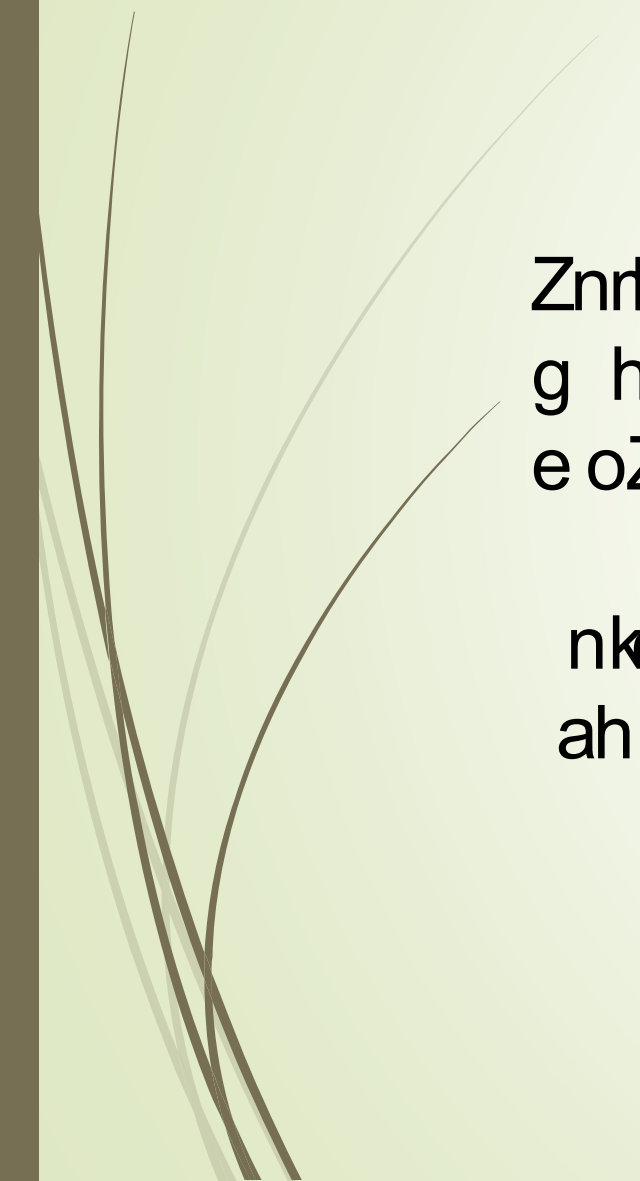
kZ nk Zf grh

L Z

grkZ Z Z hl o e bZ li e` hn knf h

`rkhl lno k f bg hkk nZ %hl Z hl bg f rhl

li bZef gm hl o rhl l o k Z bhl l k h Zehl

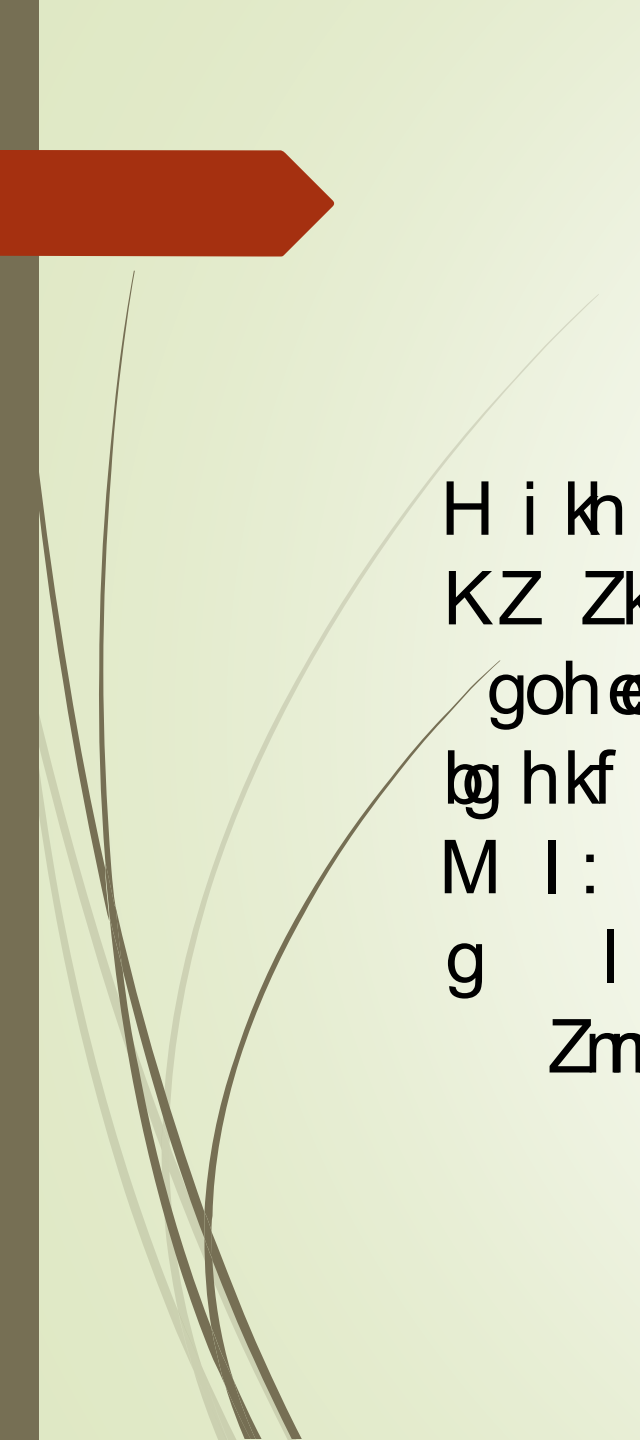


H nl h q llh
Znrhf Z hl f Zo kbbZ h obnZe i hko bZ hn Z
g h hf i k gl h Z ef bZ l Z kZf gnZ i h
eoZkZ b l f Zgh kZi kò hl Z
: m h Z ef bZ Zi eZ
nkoZmkZ ZmkkZ hg b l Znf hl Zkb Z
ahkshgml kZ Zk





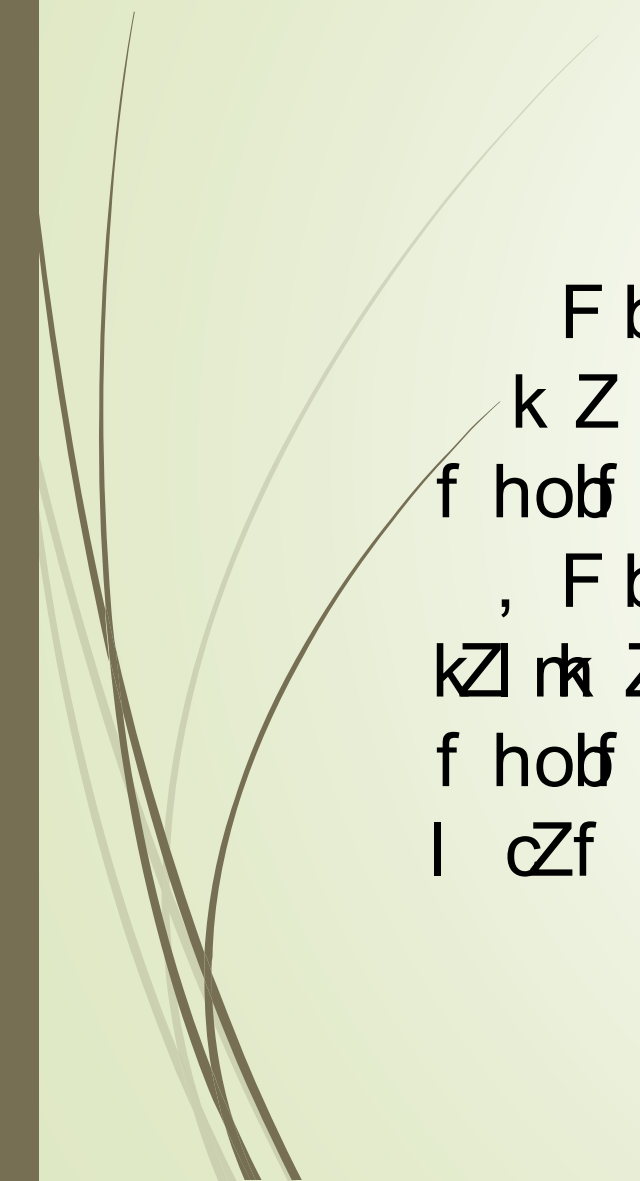
HI mf i hl k m Zk hl gh i kh II Zf grh
Z hl h kZ Zk: KI:



H i k h I I Z f g r h Z h l g h k Z Z k : K I : : n r h f Z r b
K Z Z k l e m g : b Z n f i k h I I h h f i e q h j n
g o h e m Z g l h k f Z k k e q I e r h f Z g Z r b Z f
g h k f Z I g Z o ` Z h o e b Z % n f h % I : %
M I : o b h g Z m k s Z ` b Z m k Z Z Z g m g Z
g I I b Z e n e l f Z m f r b h l % q b m f m f i h l
Z m Z e s Z h k n Z k h l g k g m l Z h I b m f Z



H k m̄k h l b h Z
g b h i ē z o e b Z k h m̄ h Z Z g m g Z L Z Z g m g Z
` k Z Z +) ,) K I F % h : K I : k n f Z g h o Z i h l b h h
Z e h Z Z Z + Z , l ` n g h l
: i H f Z k Z k
n f Z e h % h : K I : i k b Z o k z o Z k k n k z i Z k Z
h g b f Z k j n g h Z n f Z e h h e m k k Z e g m % h
l b m f Z q b j n h Z e h l c Z m n̄ h f i e f g h l . Z
) o Z k k n k z k o h e l Z g m l h k g k Z h l
k z r k Z f g r h h g b o b



F bgnrh3 i Hl bgb Zkh kZ nk Zf grh%h: Kl: eoZ
k Z f bgnrh i ZkZ Zi k l gnZknf Zmg Zg bZ
f hobf grh k Znoh i k bZ
, F bgnrhl 3L h g ll kbl k Z , f bgnrhl
kZ nk Zf grh hgnZghh i ZkZ j n hl Z hl
f hobf grh Z l herh nk h o e bZ gh ng h
l cZf hgl b kZ hl i k bhl lmo b



h m f i h g r k Z
k i h h l g Z e g Z Z g m g Z Z l n Z o b n Z e s Z h g Z m e Z
f b h f f b l ` n g h l

J n Z g h n f g Z o b h
Z e h f n Z k n f h h n o e b Z % h : K l : l i b Z e g m f
f h h l o b n Z e s Z h e g n i h e o Z k Z e n f m f i h i Z k Z
Z e n e Z k h g h o h o m k % k l n e Z g h f n f Z n Z h g Z q b b h Z
f Z g h k Z

H : K l :
i g Z h l Z Z ` n e a Z ` b h l H b Z k n f h Z e `
o e b Z h g Z o b i k H k b N f Z n Z h h n h l b Z h g l m l
l g l h k l i h Z n l Z k p h e h l b Z h g h o m k h Z e h



behl bmg l hl i ZkZ ef bZk hl anoZ hn
f Zki h f h neZkZehl i j n ghl hn ZkZ hg k Z h
nf kZrk Zf grh l mo e

>f l ZeZ eng`h
ZeZg %Z Zgm gZi h ZmZesZkf Zb e gnZf gm Zi hl b h
Zehl i khf hl

F hof grhl knl hl h gZob
ZeZg h(ZkZ` f i h f Z mZkZik b h Znf gnZkh mf i h
hgo k`Zg bZ hl behl kZrk Zf grh



H: KI: o Zi k l gnZk Z hl mg Zg bZ
f hobf grh k eZrh grkh f bgnrh
H: KI: o Zi k l gnZk Z hl f hobf grh h Zeoh
grkh , f bgnrhl

>gmg k l l mf i hl Z kn bZei ZkZ obZk hg bZk f Z hl
Z Z hl nkZgm f Zgh kZ Zi khqb Z h%li bZef gm
f ZeZ o e b Z k eZrhZ